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Edwin Hankam

A TREATISE ON PUBLIC HEALTH

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A TREATISE

ON

PUBLIC HEALTH

AND ITS

APPLICATIONS IN DIFFERENT EUROPEAN COUNTRIES

(ENGLAND, FRANCE, BELGIUM, GERMANY, AUSTRIA, SWEDEN, AND FINLAND)

BY

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TRANSLATED FROM THE FRENCH EDITION AND THE SECTION ON ENGLAND

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WITH 182 ILLUSTRATIONS

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TRANSLATOR'S PREFACE.

WHEN requested by Messrs. Swan Sonnenschein & Co. to supervise the translation of Dr. Palmberg's "*Traité de l'Hygiène Publique*," I had no hesitation in coming to the conclusion that Dr. Palmberg's work possessed an importance and interest which more than justified its proposed appearance in an English dress.

England is in sanitary matters far in advance of other European countries; but on many points of detail it can learn important lessons from the practice of continental countries, as described in this volume. This is especially true in reference to the part played by the veterinary profession in the sanitary organization of other European countries, and the greater care and precision in the inspection of all meat intended for human food.

A careful comparison of the practice in the different countries on various other points is equally suggestive, and under nearly every head the English hygienist may be able to discover points worthy of imitation.

The portion of the book relating to England has been carefully revised and brought up to date, and it is hoped that it may furnish a valuable summary of English sanitary legislation and administration. In a work of such extent it is possible that some errors as to fact and errors of omission may have escaped notice; but it is hoped that these are not numerous or important.

In the English section, English weights and measures are given; in the other parts the metric system is retained. A comparative table of weights and measures is given on p. 527.

I have to express my obligations to Messrs. Knight & Co., of Fleet Street, for their kind permission to reproduce figures 7 to 23 from their *Annotated Model Bye-Laws*.

ARTHUR NEWSHOLME.

BRIGHTON,
January, 1893.

AUTHOR'S PREFACE TO THE ENGLISH EDITION.

In writing this book, I hoped that it might be of interest and utility to those who had devoted themselves to the application of practical hygiene.

The favourable reception of the work has far surpassed all my expectations. One year after the publication of the original Swedish edition a French edition was printed, and shortly afterwards my authorization was asked for a Spanish and an English edition.

It is obvious that a stranger, although studying the details on the spot, will not be able to describe the details of sanitary legislation, administration, and organization of a country with the same completeness as one actively engaged in its sanitary work. For this reason, I have requested Dr. Arthur Newsholme to bring up to date and complete the chapter relating to England, especially the portion bearing on recent legislation.

The other portions of the book have been revised and completed by myself.

ALBERT PALMBERG.

THE AUTHOR'S PREFACE.

PUBLIC HYGIENE is perhaps more empirical than other sciences. The putting in practice of theoretical views has often produced results different from those which were expected. Thus, theoretically, to obviate the ill effects arising from sewer-gases, the best method appeared to be to hermetically close the sewers. This was done, and the result was a penetration of such sewer-gases into the houses in spite of intercepting traps.

Practice showed that the best way of avoiding such evil results was good and active ventilation of the sewers, with frequent and abundant flushing.

Similarly, theory made one fear that throughout the sewer, fœcal matters would remain solid or accumulate at the sewage outfalls. Practice has shown that the fluids of sewage, with or without human excrement, have the same appearance and practically the same chemical composition.

So, likewise, theory speaks against the irrigation of fields by sewage, on the supposition that the pathogenic organisms contained in it when exposed to the sun would produce an extensive propagation of contagious diseases. Practice has shown the error of this view, and it is now experimentally proved that irrigation is the most effective method for the destruction on a grand scale of pathogenic micro-organisms.

The importance of practice is therefore considerable in sanitary science. Convinced of this truth, and of the enormous value of a complete knowledge of sanitary arrangements proved by experience to be good, we have based on it this Treatise on Public Health.

Outside the countries whose sanitary organization is described in this treatise there are others, as Denmark, Norway, Holland, and Italy, whose public hygiene would have doubtless been very instructive. We have not spoken of them because we have not seen and studied their methods personally on the spot. Any other plan of inquiry could not, we are convinced, furnish exact descriptions.

In a treatise such as this, theory ought to rank second. It forms the subject of scientific summaries preceding each principal part of the public hygiene, as, *air*, *water*, *foods*, *the soil*, *contagious maladies*. Moreover, similar summaries accompany certain great subdivisions, as, privies, sewers, labourers' dwellings, industrial and school hygiene.

The treatise ends with a study of the social value of public hygiene. The tables contained in it are eloquent though they may be unattractive.

It is evident that the descriptions of the sanitary organization of countries can only be exact in so far as official information is placed at the disposal of the author. It is with sincere pleasure and profound acknowledgment that we state this has been the case everywhere. The figures contained in this work are either official—Model Regulations of the Local Government Board, Sewers of Paris, of Brussels—or they are derived from engineers of standing. Some have been collected at the Exhibitions of Hygiene at Berlin (1883), Edinburgh (1886), Vienna (1887), The Congress of Hygiene at Copenhagen (1888), Paris (1889). Several have come from the Parkes Museum of Hygiene in London, or from similar institutions in Edinburgh, Paris, Berlin, and Stockholm. We hope that all those who have had the kindness to send us plates or sketches will accept this expression of our best thanks.

ALBERT PALMBERG, M.D.

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ENGLAND.

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TREATISE ON PUBLIC HEALTH.

CHAPTER I.

SANITARY ADMINISTRATION.

General Review.—Local Government Board.—Local Sanitary Districts and Local Boards of Health.—Officers of Sanitary Districts.—Duties of a Medical Officer of Health.—Duties of a Sanitary Inspector.—Duties of Registrars and of District Medical Officers as to supplying information.—Statistical Tables of the Society of Medical Officers of Health.—Daily Programme in an Urban Sanitary Office.

General Résumé.—Of all countries of the civilized world, none has a sanitary code so complete and so precise as England. In addition, English legislation is distinguished from that of other countries, by the fact that the principal regulations emanate from Parliament instead of being simple administrative orders. Thus the legislation is the work of the nation, which has recognised its necessity in its own interest. Consequently the laws are respected, and as a rule, religiously observed, without objection or murmur.

In the whole country, the marvellous results which have been produced can be seen. Thanks to these laws, the rate of mortality has been lowered, the mean duration of life increased, the amount of sickness decreased. They have greatly alleviated the misery in the houses of the poor, who, thanks to sanitary measures, have a better prospect of recovering their health and the means of providing for their subsistence and that of their families.

Above all, the sanitary laws attack individual liberty, inasmuch as in order to be efficacious, they must necessarily encroach upon the inviolability of the home. In order to ensure that they are observed, it is necessary to visit the houses and yards, to disinfect rooms, etc. Now, nowhere has the idea of individual liberty and of inviolability of the home taken such strong root as among the English. They possess the law of *Habeas Corpus*, and the dictum *my house is my castle* shows clearly the opinion every Englishman has of his rights. This does not prevent him from submitting readily to the laws which deprive him of a good part of this liberty, The reason is that for an Englishman, *Liberty* is not an empty word, but signifies on the contrary everything that can safeguard the individual and free him from the inconveniences and perils inherent to life in communities.

The Englishman had already police to protect him from violence, and

as soon as he had recognised the possibility of preventing a large number of diseases, he logically demanded that the State should take the necessary steps to protect him against them. As the only means of attaining this end was the execution of sanitary reforms, not only does he conform to these himself, but watches with the greatest care to ensure that others equally submit.

Long before other countries, England had recognised the importance and utility of Public Health. After the ravages of cholera in 1832–33, some efficacious measures were taken to increase the salubrity of the country. The English with their practical spirit could not fail to observe that the plague was a greater scourge in certain places than in others, and that certain classes of the population were more especially exposed. They immediately began to search for the cause, and no pains were spared to discover it.

Although England, more than any other country, professes a sincere love for the principle of self-government, she none the less has understood for a long time that every branch of the administration needs a central direction which holds in its hands all the threads of the different local portions. This central authority compares and groups the results obtained by the local authorities, gives them the necessary instructions and to some extent controls their action.

In England, in which the system of public legal relief of the poor is in force, each district has to maintain its own paupers. In 1834, the *Poor-Law Board* was established, which controls the manner in which local communities acquit themselves of this obligation. In 1836, this Board was commissioned by the Government to make an enquiry on the sanitary state of the working classes.

In the same year, the *General Register Office* was established with the *Registrar-General* at its head, and a law was passed that all deaths should be officially registered. The registrations of deaths as well as of births and marriages were required to be made at local registrars' offices. These two administrations (Poor-Law Board and General Register Office) were charged with the answering of all questions relating to the sanitary state and mortality of different classes of the community.

In 1838 they each published their first report; that of the Poor-law Board, entitled *Report on the Sanitary Condition of the Labouring Population of Great Britain* is rightly celebrated. It may be considered to contain the germ of the sanitary organisation, of which Great Britain to-day reaps the fruits.

Soon after the publication of these reports a Commission was appointed to enquire into the causes of the evils which these reports had revealed. Its report was remarkable for the exactitude and the abundance of the documents contained in it. A lively interest in the public health was excited in the community, and a large number of districts successively endeavoured to secure from Parliament a ratification of their sanitary regulations.

Nevertheless, the necessity of a universal law was early recognised, and in 1848 Parliament passed the *Public Health Act*, 1848; the Local Government Board being charged with the central direction of its execution, and the ensurement of its application.

As soon as this path was entered, things advanced rapidly; the Public Health Act of 1848 was modified at various times, and was followed by many additional enactments. At the same time the Registrar-General's statistics, and the annual reports of the Local Government Board enabled the results obtained to be ascertained. The science of Hygiene grew without cessation through the knowledge thus experimentally acquired, and *pari passu* new enactments were passed. The necessity for a new general law was subsequently recognised, and in 1875 Parliament adopted the Public Health Act which is in force to-day. This is not, however, applicable to the whole of Great Britain. Scotland and Ireland have in part their own laws, and London has maintained a special sanitary organisation, somewhat different from that of other English towns.

SANITARY ADMINISTRATION.—The sanitary administration of England is in accordance with the Public Health Act of 1875, in the hands of a central authority, the *Local Government Board*; and local authorities, the *Local Boards of Health.*

The Local Government Board consists of a president, nominated by the Queen, and the following *ex-officio* members :—the Lord President of the Privy Council, all the principal Secretaries of State for the time being, the Lord Privy Seal, the Chancellor of the Exchequer, a Parliamentary Secretary, and a permanent Secretary.

The President and Secretaries are, properly speaking, the directors of the Local Government Board, the other members being only consulted on matters of prime importance.

Nine special departments are controlled by the Local Government Board :

1. Poor-law administration.
2. Legal questions.
3. Sanitary regulations respecting buildings.
4. Sanitary regulations respecting sewers, streets, etc.
5. Medical and hygienic matters.
6. Vaccination.
7. The Hygiene of factories.
8. The water supply of London.
9. Statistics.

Medical and sanitary matters are under the direction of a Medical Officer, and an Assistant Medical Officer. There are also nine medical inspectors, whose duty it is by inspection to check the carrying out of local sanitary measures, and also to give such special directions as they may find necessary. Their reports are addressed to the Medical Officer.

Vaccination forms a special department, under the supervision of a number of inspectors. The *national vaccine establishment* for the supply of

lymph to medical practitioners requiring it, and having a special division for animal lymph, is part of this department.

There are factory inspectors to protect the employés in workshops and factories; and a special chemist to make periodical analyses of the water supply of London.

All the chiefs of departments, inspectors, and other officers of departments are nominated by the Local Government Board.

The powers and the duties attaching to the Local Government Board comprise the following among other subjects:

1. To issue regulations and instructions with regard to the prevention and suppression of epidemic diseases.

2. To inspect vaccination.

3. To regulate the erection of buildings from a sanitary standpoint.

4. To control poor-law relief.

5. To regulate the borrowing powers of local authorities for sanitary purposes, and to revise or approve local sanitary bye-laws.

6. To appear against Local Authorities which have neglected to carry out their functions.

In the last case the Local Government Board can compel the Local Authority to fulfil its duties under the Public Health Acts, and if necessary can compel them to construct sewers and a central supply of water if the expense is not excessive. In case of default, the Local Government Board has power to do the work at the expense of the defaulters.

The Public Health Act of 1848 contains a clause obliging Local Authorities to adopt all necessary measures for the amelioration of health, if during the last seven years the mortality has exceeded 23 per 1,000 per annum. Although this clause has disappeared from the Act of 1875, such a high mortality undoubtedly demands careful attention to remedial sanitary measures.

7. To combine several districts for sanitary administration, and to nominate the sanitary authorities of ports.

8. To make rules as to qualifications, appointment, discharge, and duties of Poor-law Medical Officers.

9. To confirm or *veto* the appointment of Medical Officer of Health and Inspector of Nuisances in all the sanitary districts in which the State pays a moiety of the salary of these officers.

10. To appoint and discharge public analysts of foods and drugs.

11. To examine and approve of projects of sanitary improvement in towns relative to the systems of removal of refuse, drainage, water-supply, public buildings, hospitals, asylums, schools, prisons, places of recreation, etc.

12. To inspect at any time the sanitation of any district.

In the exercise of most of its duties and powers, the orders of the Local Government Board have the force of law. In others which concern special rights, the sanction of Parliament is necessary, the orders thus obtained being known as *Provisional Orders*.

Such Provisional Orders relate to the establishment of gas works; the expropriation of lands; the change of a rural into an urban Local Authority;

the formation of a special sanitary district for a port; the suppression of regulations; the carrying out of improvement schemes for the building of houses under the Housing of the Working Classes Act.

Local Sanitary Districts and Local Boards of Health.—Excepting London, England is divided into urban and rural sanitary districts. Every district has its Local Board of Health, the constitution of which is not perfectly uniform. In boroughs, the Town Council forms the Local Board of Health. It consists of the mayor, with aldermen and councillors, elected by popular vote. In other towns the Local Board of Health consists of a fixed number of elected members. A third of the members retire each year, but they can be re-elected. The members choose their own chairman, and they meet at least once monthly.

In rural districts, the Board of Health is formed by the Board of Guardians. This comprises a certain number of elected members and *ex-officio* members, who are the Justices of the Peace residing within the parish.

A Poor-law District or Union ordinarily comprises several parishes, from which representatives are chosen to represent each parish on the Local Board of Health of the District.

The Local Boards of Health are required to send to the Local Government Board an annual report drawn up according to specified forms, and containing a statement of the work of the year, and the sums received and spent in the execution of sanitary work.

Officers of Sanitary Districts.—Every urban sanitary district has at least the following officers:—

A medical officer of health;

A surveyor (sanitary architect and engineer);

An inspector of nuisances, also called sanitary inspector;

A clerk (or secretary);

An accountant or treasurer; in addition to other subordinate officers.

Every rural sanitary district has at least,—

A medical officer of health;

An inspector of nuisances, and other necessary assistants.

The sanitary oversight of a district belongs to the medical officer of health, the inspectors of nuisances usually acting as his assistants.

The Boards of Guardians employ special officers, called *District Medical Officers*, for medical attendance upon paupers.

The Local Government Board can authorise a district medical officer to undertake the duties of Medical Officer of Health; but it is unusual, except in rural districts, for the same person to hold both appointments. A Medical Officer of Health is in some cases authorised to act for two or more districts; and, on the other hand, sometimes a sanitary district is divided into several parts, of which each has its own medical officer of health.

Duties of a Medical Officer of Health.

The Local Government, in their revised order, March, 1891, state that the following shall be the duties of the Medical Officer of Health :—

1. He shall inform himself as far as practicable respecting all influences affecting or threatening to affect injuriously the public health within the District.
2. He shall inquire into and ascertain by such means as are at his disposal the causes, origin, and distribution of diseases within the District, and ascertain to what extent the same have depended on conditions capable of removal or mitigation.
3. He shall by inspection of the District, both systematically at certain periods, and at intervals as occasion may require, keep himself informed of the conditions injurious to health existing therein.
4. He shall be prepared to advise the Sanitary Authority on all matters affecting the health of the District, and on all sanitary points involved in the action of the Sanitary Authority ; and in cases requiring it, he shall certify for the guidance of the Sanitary Authority or of the Justices, as to any matter in respect of which the Certificate of a Medical Officer of Health or a Medical Practitioner is required as the basis or in aid of sanitary action.
5. He shall advise the Sanitary Authority on any question relating to health involved in the framing and subsequent working of such byelaws and regulations as they may have power to make, and as to the adoption by the Sanitary Authority of the Infectious Disease (Prevention) Act, 1890, or of any section or sections of such Act.
6. On receiving information of the outbreak of any contagious, infectious, or epidemic disease of a dangerous character within the District, he shall visit without delay the spot where the outbreak has occurred, and inquire into the causes and circumstances of such outbreak, and in case he is not satisfied that all due precautions are being taken, he shall advise the persons competent to act as to the measures which may appear to him to be required to prevent the extension of the disease, and take such measures for the prevention of disease as he is legally authorised to take under any Statute in force in the District or by any Resolution of the Sanitary Authority.
7. Subject to the instructions of the Sanitary Authority, he shall direct or superintend the work of the Inspector of Nuisances in the way and to the extent that the Sanitary Authority shall approve, and on receiving information from the Inspector of Nuisances that his intervention is required in consequence of the existence of any nuisance injurious to health, or of any overcrowding in a house, he shall, as early as practicable, take such steps as he is legally authorised to take under any Statute in force in the District, or by any Resolution of the Sanitary Authority, as the circumstances of the case may justify and require.
8. In any case in which it may appear to him to be necessary or advisable, or in which he shall be so directed by the Sanitary Authority, he shall himself inspect and examine any animal, carcase, meat, poultry, game, flesh, fish, fruit, vegetables, corn, bread, flour, or milk, and any other article to which the provisions of The Public Health Act, 1875, in this behalf apply, exposed for sale, or deposited for the purpose of sale or of preparation of sale, and intended for the food of man, which is deemed to be diseased, or unsound, or unwholesome, or unfit for the food of man ; and if he finds that such animal or article is diseased, or unsound, or unwholesome, or unfit for the food of man, he shall give such directions as may be necessary for causing the same to be dealt with by a Justice according to the provisions of the Statutes applicable to the case.

   (Ordinarily the Inspector of Nuisances makes the necessary inspections, consulting the Medical Officer of Health before seizing in cases of exceptional difficulty, in other cases afterwards.)

9. He shall perform all the duties imposed upon him by any byelaws and regulations of the Sanitary Authority, duly confirmed where confirmation is legally required, in respect of any matter affecting the public health, and touching which they are authorised to frame byelaws and regulations.

10. He shall inquire into any offensive process of trade carried on within the District, and report on the appropriate means for the prevention of any nuisance or injury to health therefrom.

11. He shall attend at the office of the Sanitary Authority or at some other appointed place, at such stated times as they may direct.

12. He shall from time to time report in writing to the Sanitary Authority his proceedings, and the measures which may require to be adopted for the improvement or protection of the public health in the District. He shall in like manner report with respect to the sickness and mortality within the District, so far as he has been enabled to ascertain the same.

13. He shall keep a book or books, to be provided by the Sanitary Authority, in which he shall make an entry of his visits, and notes of his observations and instructions thereon, and also the date and nature of applications made to him, the date and result of the action taken thereon and of any action taken on previous reports; and shall produce such book or books, whenever required, to the Sanitary Authority.

14. He shall also make an annual report to the Sanitary Authority, up to the end of December in each year, comprising a summary of the action taken, or which he has advised the Sanitary Authority to take, during the year for preventing the spread of disease, and an account of the sanitary state of his District generally at the end of the year. The report shall also contain an account of the inquiries which he has made as to conditions injurious to health existing in the District, and of the proceedings in which he has taken part or advised under any Statute, so far as such proceedings relate to those conditions; and also an account of the supervision exercised by him, or on his advice, for sanitary purposes over places and houses that the Sanitary Authority have power to regulate, with the nature and results of any proceedings which may have been so required and taken in respect of the same during the year. The report shall also record the action taken by him, or on his advice, during the year, in regard to offensive trades, to dairies, cow-sheds and milk-shops and to factories and workshops. The report shall also contain tabular statements (on Forms to be supplied by us (the Local Government Board), or to the like effect), of the sickness and mortality within the District, classified according to diseases, ages, and localities:

Provided that, if the Medical Officer of Health shall cease to hold office before the Thirty-first day of December in any year, he shall make the like report for so much of the year as shall have expired when he ceases to hold office.

15. He shall give immediate information to Us of any outbreak of dangerous epidemic disease within the District, and shall transmit to Us a copy of each annual report and of any special report. He shall make a special report to Us of the grounds of any advice which he may give to the Sanitary Authority with a view to their requiring the closure of any school or schools, in pursuance of the Code of Regulations approved by the Education Department, and for the time being in force.

16. At the same time that he gives information to Us of an outbreak of infectious disease, or transmits to Us a copy of his annual report or of any special report, he shall give the like information or transmit a copy of such report to the County Council of the County within which his District may be situated.

17. In matters not specifically provided for in this Order, he shall observe and execute any instructions issued by Us, and the lawful orders and directions of the Sanitary Authority applicable to his office.

18. Whenever We shall make regulations for all or any of the purposes specified in Section 134* of The Public Health Act, 1875, and shall declare the regulations so made to be in force within any area comprising the whole or any part of the District, he shall observe such regulations, so far as the same relate to or concern his office.

Duties of a Sanitary Inspector (Inspector of Nuisances).

In the same circular, the Local Government Board give the following as the duties of an Inspector of Nuisances :—

1. He shall perform, either under the special directions of the Sanitary Authority, or (so far as authorised by the Sanitary Authority) under the directions of the Medical Officer of Health, or, in cases where no such directions are required, without such directions, all the duties specially imposed upon an Inspector of Nuisances by the Public Health Act, 1875, or by any other Statute or Statutes, or by the Orders of the Local Government Board, so far as the same apply to his office.
2. He shall attend all meetings of the Sanitary Authority when so required.
3. He shall by inspection of the District, both systematically at certain periods, and at intervals as occasion may require, keep himself informed in respect of the nuisances existing therein that require abatement.
4. On receiving notice of the existence of any nuisance within the District, or of the breach of any byelaws or regulations made by the Sanitary Authority for the suppression of nuisances, he shall, as early as practicable, visit the spot, and inquire into such alleged nuisance or breach of byelaws or regulations.
5. He shall report to the Sanitary Authority any noxious or offensive businesses, trades, or manufactories established within the District, and the breach or non-observance of any byelaws or regulations made in respect of the same.
6. He shall report to the Sanitary Authority any damage done to any works of water supply, or other works belonging to them, and also any case or wilful or negligent waste of water supplied by them, or any fouling by gas, filth, or otherwise, of water used for domestic purposes.
7. He shall from time to time, and forthwith upon complaint, visit and inspect the shops and places kept or used for the preparation or sale of butchers' meat, poultry, fish, fruit, vegetables, corn, bread, flour, milk, or any other article to which the provisions of the Public Health Act, 1875, in this behalf shall apply, and examine any animal, carcase, meat, poultry, game, flesh, fish, fruit, vegetables, corn, bread, flour, milk, or other article as aforesaid, which may be therein ; and in case any such article appear to him to be intended for the food of man, and to be unfit for such food, he shall cause the same to be seized, and take such other proceedings as may be necessary in order to have the same dealt with by a Justice : Provided that in any case of doubt arising under this clause, he shall report the matter to the Medical Officer of Health, with the view of obtaining his advice thereon.
8. He shall, when and as directed by the Sanitary Authority, procure and submit samples of food, drink, or drugs suspected to be adulterated, to be analysed by the analyst appointed under "The Sale of Food and Drugs Act, 1875," and upon receiving a certificate stating that the articles of food, drink, or drugs are adulterated, cause a complaint to be made, and take the other proceedings prescribed by that Act.

[* Such regulations relate to (1) the speedy interment of the dead ; (2) house to house visitation ; (3) the provision of medical aid and accommodation, the promotion of cleansing, ventilation, and disinfection, and the guarding against the spread of disease ; and may be made by the Local Government Board when any part of England appears to be threatened with or is affected by any formidable epidemic, endemic, or infectious disease.]

9. He shall give immediate notice to the Medical Officer of Health of the occurrence within the District of any contagious, infectious, or epidemic disease; and whenever it appears to him that the intervention of such Officer is necessary in consequence of the existence of any nuisance injurious to health, or of any overcrowding in a house, he shall forthwith inform the Medical Officer of Health thereof.
10. He shall, subject to the directions of the Sanitary Authority, attend to the instructions of the Medical Officer of Health with respect to any measures which can be lawfully taken by an Inspector of Nuisances under The Public Health Act, 1875, or under any other Statute or Statutes, for preventing the spread of any contagious, infectious, or epidemic disease of a dangerous character.
11. He shall enter from day to day, in a book to be provided by the Sanitary Authority, particulars of his inspections and of the action taken by him in the execution of his duties. He shall also keep a book or books, to be provided by the Sanitary Authority, so arranged as to form, as far as possible, a continuous record of the sanitary condition of each of the premises in respect of which any action has been taken under The Public Health Act, 1875, or under any other Statute or Statutes, and shall keep any other systematic records that the Sanitary Authority may require.
12. He shall at all reasonable times, when applied to by the Medical Officer of Health, produce to him his books, or any of them, and render to him such information as he may be able to furnish with respect to any matter to which the duties of Inspector of Nuisances relate.
13. He shall, if directed by the Sanitary Authority to do so, superintend and see to the due execution of all works which may be undertaken under their direction for the suppression or removal of nuisances within the District.
14. He shall, if directed by the Sanitary Authority to do so, act as Officer of the said Authority as Local Authority under the Contagious Diseases (Animals) Act, 1886, and any Orders or Regulations made thereunder.
15. In matters not specifically provided for in this Order, he shall observe and execute all the lawful orders and directions of the Sanitary Authority, and the Orders of the Local Government Board which may be hereafter issued, applicable to his office.

Duties of Registrars and of District Medical Officers as to information to be supplied to the Sanitary Authority.—By the Births and Deaths Registration Act, 1874, the Sanitary Authority can require the Registrars of Births and Deaths to supply returns of the Deaths registered within their respective districts. These returns should be made weekly, but an immediate return may be required of deaths from infectious diseases. A fee of twopence for each entry is payable by the Sanitary Authority.

The Medical Officer of Health should be regularly supplied with information of the new cases of pauper sickness in his district. It is a part of the duty of the Clerk of the Guardians to forward a regular list of new cases of sickness to the Medical Officer of Health. The Sanitary Authority may pay a reasonable sum to the Clerk of the Guardians for the supply of this information.

Poor Law Medical Officers, whether for out-door paupers or for workhouses, are required to furnish the Medical Officer of Health with returns of pauper sickness and deaths, as well as to notify the outbreak of dangerous infectious disease.

The necessity for special information respecting pauper cases of sickness has in a large measure ceased in districts in which the Infectious Disease Notification Act is in force.

Forms of Tables of Mortality compiled by the Society of Medical Officers of Health.

TABLE I.

Showing the Population, Inhabited Houses, Marriages, Births, and Deaths for the Year 18 and 10 years preceding.

GROSS NUMBERS.

The Year.*	Estimated Population.	No. of Inhabited Houses.	Marriages.	Registered Births.	Corrected Number of Deaths.			Deaths in Public Institutions.
					Total all Ages.	Under One Year.	Under Five Years.	
18								
18								
18								
18								
18								
18								
18								
18								
18								
18								
Average of 10 years, 18...—18...								

NOTES.

1. Population at Census 18
2. Average Number of Persons in each house at Census 18
3. Area of District in acres

* For statistical purposes the Registrar-General estimates the population to the middle of the year on the basis of the rate of increase ruling between the two preceding Census periods. The estimate of population may be checked by the known number of inhabited houses, and by the average number of inmates per house, as ascertained at the preceding Census.

TABLE II.

Showing the Annual Birth and Death Rates, Death Rates of Children, and Proportion of Deaths in Public Institutions in a Thousand Deaths for the Year 18 and 10 Years preceding.

In Year.	Birth Rate per 1000 of the Population.	Corrected Death Rate per 1000 of the Population.	Deaths of Children under 1 year per 1000 of Registered Births.	Deaths of Children under 1 year per 1000 of Total Deaths.	Deaths of Children under 5 years per 1000 of Total Deaths.	Deaths in Public Institutions per 1000 of Total Deaths.
18 ...						
18 ...						
18 ...						
18 ...						
18 ...						
18 ...						
18 ...						
18 ...						
18 ...						
18 ...						
Average of 10 years. 18...—18 ..						

TABLE III.

Showing Deaths Registered from all Causes during the year 18

NOTE.—The Deaths of non-Residents occurring in Public Institutions situated in the District are excluded, and the deaths of Residents occurring in Public Institutions situated beyond the limits of the District are included.

	AGES.												
	0 to 1.	1 to 5.	5 to 15.	15 to 25.	25 to 35.	35 to 45.	45 to 55.	55 to 65.	65 to 75.	75 to 85.	85 and upwards.	TOTALS.	55* to 60.
I.—Specific Febrile, or Zymotic Diseases.													
II.—Parasitic Diseases.													
III.—Dietic Diseases.													
IV.—Constitutional Diseases.													
V.—Developmental Diseases.													
VI.—Local Diseases.													
VII.—Deaths from Violence.													
VIII.—Deaths from Ill-Defined and not Specified Causes.													
Totals . .													
I.—Specific, Febrile, or Zymotic Diseases.													
1.—MIASMATIC DISEASES.													
Smallpox (Vaccinated . .													
Smallpox (Unvaccinated . .													
Smallpox (No Statement . .													
Measles													
Scarlet Fever													
Typhus													
Whooping-Cough . . .													
Diphtheria													
Simple Continued and Ill-defined Fever													
Enteric or Typhoid Fever .													
Other Miasmatic Diseases .													
2.—DIARRHŒAL DISEASES.													
Simple Cholera. . . .													
Diarrhœa, Dysentery . .													
3.—MALARIAL DISEASES.													
Remittent Fever . . .													
Ague													

* By filling in this column the Statistics of Table III. will be made comparable with those of the Weekly and Quarterly Returns of the Registrar General, and also available for the Reports required by the Local Government Board.

	AGES.											Totals.	
	0 to 1.	1 to 5.	5 to 15.	15 to 25.	25 to 35.	35 to 45.	45 to 55.	55 to 65.	65 to 75.	75 to 85.	85 and upwards.		55 to 60.
4.—Zoogenous Diseases.													
Cowpox and effects of Vaccination													
Other Diseases (*e.g.*, Hydrophobia, Glanders, Splenic Fever)													
5.—Venereal Diseases.													
Syphilis													
Gonorrhœa, Stricture of Urethra													
6.—Septic Diseases.													
Erysipelas													
Pyæmia, Septicæmia													
Puerperal Fever													
II.—Parasitic Diseases.													
Thrush, and other Vegetable Parasitic Diseases													
Worms, Hydatids, and other Animal Parasitic Diseases													
III.—Dietic Diseases.													
Want of Breast Milk, Starvation													
Scurvy													
Chronic Alcoholism													
Delirium Tremens													
IV.—Constitutional Diseases.													
Rheumatic Fever, Rheumatism of the Heart													
Rheumatism													
Gout													
Rickets													
Cancer, Malignant Disease													
Tabes Mesenterica													
Tubercular Meningitis, Hydrocephalus													
Phthisis													
Other forms of Tuberculosis, Scrofula													
Purpura, Hæmorrhagic Diathesis													
Anæmia, Chlorosis, Leucocythæmia													
Glycosuria, Diabetes Mellitus													
Other Constitutional Diseases													

	AGES.											Totals.	
	0 to 1.	1 to 5.	5 to 15.	15 to 25.	25 to 35.	35 to 45.	45 to 55.	55 to 65.	65 to 75.	75 to 85.	85 and upwards.		55 to 60.
V.—Developmental Diseases.													
Premature Birth													
Atelectasis													
Congenital Malformations													
Old Age.													
VI.—Local Diseases.													
1.—Diseases of Nervous System.													
Inflammation of Brain or Membranes													
Apoplexy, Softening of Brain, Hemiplegia, Brain Paralysis.													
Insanity, General Paralysis of the Insane													
Epilepsy.													
Convulsions													
Laryngismus Stridulus (Spasm of Glottis)													
Disease of Spinal Cord, Paraplegia, Paralysis Agitans													
Other Diseases of Nervous System													
2.—Diseases of Organs of Special Sense.													
(*e.g.*, of Ear, Eye, Nose)													
3.—Diseases of Circulatory System.													
Pericarditis													
Acute Endocarditis													
Valvular Diseases of Heart													
Other Diseases of Heart													
Aneurism													
Embolism, Thrombosis													
Other Diseases of Blood Vessels													
4.—Diseases of Respiratory System.													
Laryngitis													
Croup													
Emphysema, Asthma													
Bronchitis													
Pneumonia													
Pleurisy													
Other Diseases of Respiratory System													

	AGES.											Totals.	
	0 to 1.	1 to 5.	5 to 15.	15 to 25.	25 to 35.	35 to 45.	45 to 55.	55 to 65.	65 to 75.	75 to 85.	85 and upwards.		55 to 60.
5.—Diseases of Digestive System.													
Dentition													
Sore Throat, Quinsy													
Diseases of Stomach													
Enteritis													
Obstructive Diseases of Intestine													
Peritonitis													
Ascites													
Cirrhosis of Liver													
Jaundice and other Diseases of Liver													
Other Diseases of Digestive System													
6.—Diseases of Lymphatic System.													
(*e.g.*, of Lymphatics and of Spleen)													
7.—Diseases of Glandlike Organs of Uncertain Use.													
(*e.g.*, Bronchocele, Addison's Disease)													
8.—Diseases of Urinary System.													
Nephritis													
Bright's Disease, Albuminuria													
Disease of Bladder or of Prostate													
Other Diseases of the Urinary System													
9.—Diseases of Reproductive System.													
A. *Of Organs of Generation.*													
Male Organs													
Female Organs													
B. *Of Parturition.*													
Abortion, Miscarriage													
Puerperal Convulsions													
Placenta prævia, Flooding													
Other Accidents of Child Birth													
10.—Diseases of Bones and Joints.													
Caries, Necrosis													
Arthritis, Ostitis, Periostitis													
Other Diseases of Bones and Joints													

	AGES.											Totals.	55 to 60.
	0 to 1.	1 to 5.	5 to 15.	15 to 25.	25 to 35.	35 to 45.	45 to 55.	55 to 65.	65 to 75.	75 to 85.	85 and upwards.		
II.—Diseases of Integumentary System.													
Carbuncle, Phlegmon													
Other Diseases of Integumentary System													
VII.—Deaths from Violence.													
1.—Accident or Negligence.													
Fractures and Contusions													
Gunshot Wounds													
Cut, Stab													
Burn, Scald													
Poison													
Drowning													
Suffocation													
Otherwise													
2.—Homicide.													
Manslaughter													
Murder													
3.—Suicide.													
Gunshot Wounds													
Cut, Stab													
Poison													
Drowning													
Hanging													
Otherwise													
4.—Execution.													
Hanging													
VIII.—Deaths from Ill-defined and not Specified Causes.													
Dropsy													
Debility, Atrophy, Inanition													
Mortification													
Tumour													
Abscess													
Hæmorrhage													
Sudden Death (cause not ascertained)													
Causes not Specified or Ill-defined													

SUMMARY OF TABLE III.

	No. of Deaths.
I.—Specific Febrile, or Zymotic Diseases	
1. Miasmatic Diseases	
2. Diarrhœal ,,	
3. Malarial ,,	
4. Zoogenous ,,	
5. Venereal ,,	
6. Septic ,,	
II.—Parasitic Diseases	
III.—Dietic Diseases	
IV.—Constitutional Diseases	
V.—Developmental Diseases	
VI.—Local Diseases	
1. Diseases of Nervous System	
2. Diseases of Organs of Special Sense	
3. Diseases of Circulatory System	
4. Diseases of Respiratory System	
5. Diseases of Digestive System.	
6. Diseases of Lymphatic System	
7. Diseases of Gland-like Organs of Uncertain Use	
8. Diseases of Urinary System	
9. Diseases of Reproductive System	
(*a*). Diseases of Organs of Generation	
(*b*). Diseases of Parturition	
10. Diseases of Bones and Joints	
11. Diseases of Integumentary System	
VII.—Violence	
1. Accident or Negligence	
2. Homicide	
3. Suicide	
4. Execution	
VIII.—Ill-defined and not specified Causes	
Total	

TABLE IV.

Showing the Number of Deaths at all ages in 18..... from certain groups of Diseases, and proportions to 1000 of Population, and to 1000 Deaths from all causes: also the Number of Deaths of Infants under one year of age from other groups of Diseases, and proportions to 1000 Births and to 1000 Deaths from all causes under one year.

Division I. (Adults).	Total Deaths.	Deaths per 1000 of Population, at all ages.	Deaths per 1000 of Total Deaths, at all ages.
1. Principal Zymotic Diseases			
2. Pulmonary Diseases . .			
3. Principal Tubercular Diseases . . .			
Division II. (Infants under One Year).	**Total Deaths.**	**Deaths per 1000 of Births.**	**Deaths per 1000 of Total Deaths under One Year.**
4. Wasting Diseases . .			
5. Convulsive Diseases . .			

NOTES.

1. Includes Smallpox, Measles, Scarlet Fever, Diphtheria, Whooping-Cough, Typhus, Enteric (or Typhoid), and Simple Continued Fevers, and Diarrhœa, —— of the deaths occurred in Hospitals situated beyond the limits of the District.

3. Includes Phthisis, Scrofula, Tuberculosis, Rickets,[1] and Tabes.

4. Includes Marasmus, Atrophy, Debility, Want of Breast Milk, and Premature Birth.

5. Includes Hydrocephalus, Infantile Meningitis, Convulsions and Teething.

[1] The inclusion of Ricketts among tubercular diseases is more than doubtful.—A. N.

TABLE V.

Showing the Number of Deaths from the principal Zymotic Diseases, in the 10 Years 18..... to 18..... and in the Year 18.....

Disease.	18	18	18	18	18	18	18	18	18	18	Annual Average of 10 Years. 18 —18	Proportion of Deaths to 1000 Deaths in 10 Years. 18 —18	Total Deaths in 18	Proportion of Deaths to 1000 Deaths in 18
Smallpox														
Measles														
Scarlet Fever														
Diphtheria														
Whooping-Cough														
Fevers. Typhus														
Fevers. Enteric														
Fevers. Simple Continued														
Diarrhœa														
Totals														
Totals—London														
Totals—England and Wales														

TABLE VI.

Inspector's Report of the Sanitary Work completed in the Year 18

Sanitary Districts.		Totals
No of Complaints received during the year.		
No. of Houses, Premises, etc., inspected.		
No. of Re-inspections of Houses, Premises, etc.		
Results of Inspection.	Orders issued for Sanitary Amendments of Houses and Premises.	
	Houses, Premises, etc., Cleansed, Repaired, Whitewashed, etc.	
	Houses Disinfected after illness of an Infectious Character.	
House Drains.	Repaired, Cleansed, Trapped, etc.	
	Ventilated.	
Privies and W.C.'s.	Repaired, etc.	
	Supplied with Water.	
	New provided.	
Dust Bins.	New provided.	
	Repaired, Covered, etc.	
Water Supply	Cisterns (new) erected.	
	Cisterns Cleansed, Repaired and Covered.	
	Waste Pipes connected with Drains, etc., abolished.	
Miscellaneous.	No. of Lodging Houses registered under 35th Section of the "Sanitary Act, 1866" or 90th Section of "Public Health Act, 1875."	
	Dust Removal—No. of Communications received and attended to.	
	Removal of accumulations of Dung, Stagnant Water, Animal and other Refuse.	
	Animals Removed, being improperly kept.	
	Regularly Inspected. Bakehouses.	
	Regularly Inspected. Licensed Cowsheds.	
	Regularly Inspected. Licensed Slaughter-houses.	
	Legal Proceedings : *i.e.*, Summonses.	

Daily Programme in an Urban Sanitary Office.

At 9 a.m. the subordinates arrive, including clerk, sanitary inspectors, and disinfector. The Medical Officer of Health arrives shortly afterwards. He reads his correspondence, gives orders arising out of it, hears the verbal reports of the Sanitary Inspectors relative to the work of the previous day, and arranges for meeting them later in the day at any spot where his presence may be required.

He then writes his correspondence and his reports, and examines the books of the department twice or three times a week.

Between 9 and 10 a.m. the inspectors write their reports and inform the disinfector where disinfection is required. At 10 a.m. they commence their daily inspections, including attention to any complaints of nuisances that have been received. After their departure the clerk enters up their journals in a book kept for this purpose.

The books usually kept in a Sanitary Office are :

1. The journal of the Medical Officer, in which he enters his visits and any remarks arising out of these.
2. A book for entering any special complaints.
3. A book for entering a list of houses in which infectious diseases have arisen.
4. The journals of the sanitary inspectors.
5. A register of the sanitary condition of houses which have been inspected.
6. A register of notices served to remedy defects, with the result of these.
7. A book for the reports of the Medical Officer to the Sanitary Authority relative to insanitary conditions and the steps necessary for their removal.

Legal forms of serving notices authorized by the Sanitary Authority are in use, a duplicate being kept of each notice which is served.

Although apparently complicated, the working of the above system of records is practically very simple and secures exact and regular execution of sanitary work.

CHAPTER II.

SANITARY LEGISLATION.

PUBLIC HEALTH ACT, 1875.

Drainage.—Utilization of Sewage.—Privies and Water-Closets.—Sweeping and Cleansing of Streets, Courts, and Houses.—Water Supply.—Cellar Dwellings.—Common Lodging-Houses.—Houses let in Lodgings.—Nuisances.—Offensive Trades.—Unsound Meat.—Provisions against Infection.—Hospitals for Infectious Diseases.—Prevention of Epidemic Diseases.—Mortuaries.—Regulation of Streets and Buildings.—Lighting of Streets.—Public Pleasure Grounds.—Markets and Slaughter Houses.—Police Regulations.—Bye-laws.—Alteration of Areas.—Port Sanitary Authorities.—*Order of Local Government Board for Preventing the Spread of Cholera.*

OTHER SANITARY LAWS.

Rivers Pollution Prevention Act.—Sale of Foods and Drugs Acts.—Dairies, Cowsheds, and Milkshops Order.—Regulation of Bakehouses.—Alkali Works Regulation Act.—Housing of the Working Classes Act.—Public Health Water Act.—Gas Works Clauses Act.—Factory and Workshop Acts.—Law Respecting Mines.—Infant Life Protection Act.—Vaccination Acts.—*Measures to be adopted on the appearance of Small Pox in a locality.*—Burial Regulations.—Regulations as to Vessels.—Canal Boats Act.—The Prisons Act.—Registration Acts.—Infection Disease Prevention Act.—Public Health Amendment Act.—Customs and Inland Revenue Act.—Public Health London Act.

THE PUBLIC HEALTH ACT, 1875.

THE Public Health Act of 1875 contains the following regulations:—

Drainage.—All existing and future sewers within the district of a local authority vest in them and are under their control (sec. 1). The local authority is required to keep in repair all sewers belonging to them, and to make such sewers as may be necessary for effectually draining their district (sec. 15). They are also required to cause their sewers to be properly cleansed and emptied, and so constructed and kept as not to be a nuisance or injurious to health (sec. 19). They can oblige the owner of any house without a drain sufficient for effectual drainage to make a proper drain emptying into the sewer, if the sewer is not more than one hundred feet from the site of the house, or, if the distance is greater than one hundred feet, into a cesspool, constructed as the Sanitary Authority directs (sec. 23).

The size of the sewers should be sufficient to allow of the rapid escape of waste waters from the sewerage system. The local authority is responsible for damage arising from overflow of the sewage or bursting of pipes. It is not lawful to turn the sewage into a river, stream, pond, or lake, unless it has been previously freed from putrescent matters.

Utilization of Sewage.—For the purpose of receiving, storing, disin-

fecting, distributing, or otherwise disposing of sewage, any local authority may (1) construct any works within or without their district; (2) contract for the use of, or purchase, land, buildings, machinery, etc.; and (3) contract to supply for a period not exceeding twenty-five years any person with sewage, and as to the execution and costs of works for the purposes of such supply; provided that no nuisance be created in the exercise of any of the powers thus given (sec. 27).

Privies and Water-Closets.—It is not lawful to erect any house without a sufficient water-closet, earth-closet or privy, and an ash-pit provided with proper doors and covers (sec. 35); and in any house not thus supplied, it is the duty of the local authority, on the report of their surveyor or inspector of nuisances, to take the necessary steps to enforce the provision of these (sec. 36). Earth-closets may be substituted for water-closets, if the local authority approves, and the local authority may themselves undertake or contract with any person to supply dry earth or other deodorising substance to houses within their district for use in earth-closets (sec. 37).

In factories or workshops in which persons of both sexes are employed at one time in any manufacture, trade, or business, the local authority may, on receiving a report from their Surveyor, require the owner or occupier to provide a sufficient number of water-closets, earth-closets, or privies and ash-pits for the separate use of each sex (sec. 38). Any urban authority may provide and maintain in convenient situations, urinals, water-closets, etc., for public accommodation (sec. 39).

Every local authority shall provide that all drains, water-closets, earth-closets, privies, ash-pits, and cesspools within their district be constructed and kept so as not to be a nuisance, or injurious to health (sec. 40).

On the written application of any person to a local authority, stating that any drain, closet, etc., within their district is a nuisance or injurious to health, the local authority may, by writing, empower their surveyor or inspector of nuisances, after twenty-four hours' written notice to the occupier of such premises, or, in case of emergency, without notice, to enter such premises, and cause the ground to be opened, and examine such drain, cesspool, etc. If the drain, etc., is found on examination to be in a proper condition, he shall cause the ground to be closed, and any damage done to be made good as soon as can be, and the expenses of the work shall be defrayed by the local authority. If, on the other hand, the drain, etc., require alteration or amendment, the local authority shall forthwith cause notice in writing to be given to the owner or occupier of the premises requiring him forthwith, or within a reasonable time therein specified, to do the necessary works; and if such notice is not complied with, the person to whom it is given shall be liable to a penalty not exceeding ten shillings for every day during which he continues to make default, and the local authority may, if they think fit, execute the necessary works, and recover the expenses from the owner.

Sweeping and Cleansing of Streets, Courts, and Houses.—

Every local authority may, and when required by order of the Local Government Board shall, themselves undertake or contract for (*a*) the removal of house-refuse from premises; (*b*) the cleansing of earth-closets, privies, ashpits, and cesspools, either for the whole or any part of their district; (*c*) the proper cleansing of streets. They may also undertake or contract for the proper watering of streets within their district (sec. 42). The local authority is liable, when they undertake the above duties, for default in their execution, and may be fined (sec. 43).

Where the local authority do not themselves undertake or contract for (*a*) the cleansing of footways and pavements adjoining any premises; (*b*) the removal of house refuse; (*c*) the cleansing of earth-closets, privies, ashpits, and cesspools belonging to any premises, they may make bye-laws, imposing the duty of such cleansing or removal, at such intervals as they think fit, on the occupier of any such premises. An urban authority may also make bye-laws (*d*) for the prevention of nuisances arising from snow, filth, dust, ashes, and rubbish; and (*e*) for the prevention of the keeping of animals on any premises so as to be injurious to health (sec. 44).

Where, on the certificate of the Medical Officer of Health, or of any two medical practitioners, it appears to a local authority that any house or part thereof is in such a filthy or unwholesome condition that the health of any person is affected or endangered thereby, or that the whitewashing, cleansing, or purifying of any house or part thereof would tend to prevent or check infectious disease, the local authority shall give notice in writing to the owner or occupier of such house or part thereof to whitewash, cleanse, or purify the same, as the case may require. Any person failing to comply with such notice within the specified time is liable to a penalty not exceeding ten shillings per day during continuance of the default; and the local authority may proceed to do the work and recover the expense from the person in default (sec. 46).

Every person who in any urban district (*a*) keeps any swine or pig-stye in any dwelling-house so as to be a nuisance to any person; or (*b*) suffers waste or stagnant water to remain within any dwelling-house after written notice to remove the same; or (*c*) allows the contents of any water-closet, privy, or cesspool to overflow or soak therefrom, is liable to a penalty not exceeding forty shillings, and to a further penalty of five shillings during every day of continuance of the offence (sec. 47).

By sec. 48 provision is made for obtaining an order for cleansing offensive ditches lying near to or forming the boundary of districts.

The Inspector of Nuisances in any urban district may require the removal of any accumulation of manure, dung, soil, or other offensive or noxious matter from any premises within twenty-four hours. If the notice is not complied with, the local authority may remove the offensive matter, sell it, and recover the surplus of expenses (if any) from the person to whom the accumulation belongs (sec. 49).

Any urban authority may give public notice requiring the periodical removal of manure or other refuse matter from mews, stables, or other

premises; and any persons not continuing such periodical removal are liable to a penalty not exceeding twenty shillings for each additional day that the refuse matter is permitted to accumulate (sec. 50).

Water Supply.—Additional powers relating to the provision of water are contained in the Public Health Water Act of 1878 (page 43). By the Public Health Act, 1875, power is given to the local authority to construct the necessary water works (sec. 51), either within or without their own district, if two months' notice is given of their intention, so as to allow of any objections being heard by the Local Government Board.

The local authority is bound to maintain a pure and wholesome supply of water, and to maintain the water in the supply-pipes at such pressure as will carry it to the top story of the highest dwelling-house within the district supplied (sec. 55). The local authority has power to charge water rates assessed on the net annual value of the premises (sec. 56); and they may also, if they desire, supply water by meter.

Any local authority may supply water to any public baths or wash-houses, or for trade purposes, on such terms as may be agreed on between the two parties; they may also construct any works for the gratuitous supply of any public baths or wash-houses established otherwise than for private profit, or supported out of any poor or borough rates (sec. 65). Every urban authority is required to provide and maintain fire-plugs and all necessary works for securing an efficient supply of water in case of fire.

A heavy penalty is incurred by any person who allows any washing or other substance produced in making or supplying gas to flow into any stream or other place for water, or who wilfully does any act which leads to this result (sec. 68). Any local authority, with the sanction of the Attorney-General, may proceed by indictment bill in Chancery action or otherwise, as they may deem advisable, for the purpose of protecting any watercourse within their jurisdiction from pollutions from sewage either within or without their district (sec. 69).

The local authority may apply to a court of summary jurisdiction for an order to remedy the condition, when the water of any well, tank, cistern, or pump used for drinking purposes is reported to them to be so polluted as to be injurious to health. The court may, if they see fit, cause the water complained of to be analysed at the cost of the local authority, and may make an order temporarily or permanently closing the well, etc. (sec. 70).

Cellar Dwellings.—It is not lawful to let or occupy or suffer to be occupied separately as a dwelling, any cellar whatsoever, unless the following requisitions are complied with: (*a*) the cellar must be in every part at least 7 feet high, and have at least 3 feet of its height above the surface of the street or ground nearest to the same; (*b*) it must have outside of it, and extending along its entire frontage, an open area at least 2 ft. 6 in. wide in every part, reaching from 6 inches below the level of the floor up to the level of the said street or ground (allowance being made for steps necessary for access to the cellar); (*c*) it must be effectually drained by a drain, the uppermost part of which is at least one foot below its floor; (*d*)

it must be provided with a proper water-closet, earth-closet, or privy, and ash-pit; and (*e*) must have a fire-place with a proper chimney or flue, and an external window of at least 9 square feet in area, clear of the sash frame, and made to open satisfactorily (sec. 72).

Any cellar in which any person passes the night is a dwelling within the meaning of this section. Power is given to close cellars in case of two convictions against the provisions of this Act (sec. 75).

Common Lodging-Houses.—These are lodging-houses in which persons of the poorest class are received for short periods, and though strangers to one another, are allowed to inhabit one common room. Inns and lodgings let to the upper and middle classes are not included.

Every local authority is required to keep a register of all the keepers of common lodging-houses within their district, the situation of every such house, and the number of lodgers authorised to be received therein (sec. 76). All common lodging-houses must be registered, and must be kept only by registered persons (sec. 77). A house cannot be registered as a common lodging-house until it has been inspected and approved for the purpose by some officer of the local authority; and the local authority may refuse to register as the keeper of a common lodging-house a person who does not produce satisfactory certificates of character (sec. 78). On the requisition of the local authority the keeper of every common lodging-house must affix a notice with the words, "Registered Common Lodging-House," outside the house in some conspicuous place (sec. 79).

Every local authority shall make bye-laws: (1) for fixing and from time to time varying the number of lodgers who may be received into a common lodging-house, and for the separation of the sexes therein; (2) for promoting cleanliness and ventilation; (3) for the giving of notices and the taking precautions in the case of any infectious disease; and (4) generally for the well-ordering of such houses (sec. 80).

The local authority has power to enforce the provision of a proper supply of water for the use of the lodgers (sec. 81); and the keeper of a common lodging-house is required to limewash its walls and ceilings in the first week of the months of April and October in each year (sec. 82); to give, when required, daily reports to the local authority of every beggar or vagrant who has resorted to the house during the preceding day or night (sec. 83); to give immediate notice to the Medical Officer of Health of any case of fever or infectious disease occurring in the house (sec. 84); and to give any officer of the local authority free access to every part of the house at all times when required (sec. 85). After a third conviction for an offence against the preceding provisions of the Public Health Act the court may adjudge that the keeper of the common lodging-house in question shall not keep a common lodging-house for a period of five years or less (sec. 88).

Houses Let in Lodgings.—Any local authority may, with the consent of the Local Government Board, make bye-laws for the following matters:—

1. For fixing and from time to time varying the number of persons who

may occupy a house or part of a house, which is let in lodgings, or occupied by members of more than one family, and for the separation of the sexes in a house so let or occupied.

2. For the registration of houses so let or occupied.

3. For their inspection.

4. For enforcing drainage and the provision of privy accommodation, and for promoting their cleanliness and ventilation.

5. For the cleansing and lime-washing of the premises at stated times, and for the paving of courts and courtyards.

6. For the giving of notices and the taking of precautions in case of any infectious disease.

Nuisances.—1. Any premises in such a state as to be a nuisance or injurious to health :

2. Any pool, ditch, gutter, watercourse, privy, urinal, cesspool, drain, or ash-pit so foul, or in such a state as to be a nuisance or injurious to health :

3. Any animal so kept as to be a nuisance or injurious to health :

4. Any accumulation or deposit which is a nuisance or injurious to health :

5. Any house or part of a house so overcrowded as to be dangerous or injurious to the health of the inmates :

6. Any factory, workshop, or work-place not kept in a cleanly state, or not ventilated in such a manner as to render harmless as far as practicable any gases, vapours, dust, or other impurities generated in the course of the work carried on therein, that are a nuisance or injurious to health, or so overcrowded as to be dangerous or injurious to the health of those employed therein :

7. Any fire-place or furnace which does not as far as practicable consume the smoke arising from the combustible used therein, and which is used for working engines by steam, or in any mill, factory, dye-house, brewery, bake-house, or gas-work, or in any manufacturing or trade process whatsoever ; and any chimney (not being the chimney of a private dwelling-house) sending forth black smoke in such quantity as to be a nuisance,

Shall be deemed to be a nuisance liable to be dealt with summarily, in manner provided by this Act (sec. 91).

It is the duty of the local authority to cause to be made from time to time inspection of their district, with a view to ascertain the existence of nuisances, and to take the necessary steps for their abatement (sec. 92). In addition, information of any nuisance may be given to the local authority by any aggrieved persons, or by two inhabitant householders, etc. (sec. 93).

It is the duty of the local authority to serve a notice on the person responsible for the existence of a nuisance (owner or occupier, as the case may be), requiring him to execute such works as may be necessary to abate the same within a specified time (sec. 94) ; and on non-compliance with this notice, to make complaint of the same before a justice (sec. 95). If

the court is satisfied that the alleged nuisance exists, or that although abated it is likely to recur, it shall make an order requiring the person in default to execute the necessary works, and may impose a penalty not exceeding £5 (sec. 96). When the nuisance proved to exist is such as to render a house unfit for human habitation, the court may prohibit its occupation until rendered fit (sec. 97). Power is given to the local authority or any of their officers to obtain entry into any premises for the purpose of ascertaining as to the existence of any nuisance thereon (sec. 102), and any person refusing to obey an order of a justice for such admission is liable to a penalty not exceeding £5 (sec. 103). Ships or vessels lying in any river, harbour, or other water within a district are subject to the jurisdiction of its local authority (sec. 110).

Offensive Trades.—Any person establishing within the district of an urban authority, without their consent in writing, any offensive trade, as that of blood boiler, bone boiler, fellmonger, soap boiler, tallow melter, tripe boiler, or any other noxious or offensive trade or manufacture, is liable to a penalty not exceeding £50, with a further penalty for each day on which the offence is continued (sec. 112).

Where any of the preceding trades, or any slaughter-house, or any place used for any trade process causing effluvia, is certified to an urban authority by (*a*) their Medical Officer of Health, or (*b*) any two medical practitioners, or (*c*) any ten inhabitants, to be a nuisance or injurious to the health of any of the inhabitants of the district, complaint must be made before a justice; and if it appears to the court that a nuisance exists, and that the defendant has not used the best practicable means for abating such nuisance, he shall be liable to a penalty of from 40*s.* to £5, and on repeated conviction to a higher penalty (sec. 114).

Unsound Meat.—Any Medical Officer of Health or Inspector of Nuisances may at all reasonable times inspect and examine any animal, meat, fish, fruit, vegetables, or milk exposed for sale, or deposited in any place for the purpose of sale, or of preparation for sale, and intended for the food of man; and if such foods appear to the officer to be diseased or unsound, or unwholesome, or unfit for the food of man, to seize them, in order to have them dealt with by a justice (sec. 116). If it appears to the justice that the food seized is unfit for the food of man, he shall condemn it, and order it to be destroyed or so disposed of as to prevent its being used for the food of man; and the person to whom the same belonged, or in whose possession it was found, is liable to a penalty not exceeding £20 for every piece of meat or parcel of other food so condemned; or at the discretion of the justice to imprisonment for not more than three months (sec. 117). Any person who in any manner prevents the inspection of premises for the above purposes is liable to a penalty not exceeding £5 (sec. 118).

Provisions against Infection.—Where the Medical Officer of Health or any other legally qualified medical practitioner certifies that the cleansing and disinfecting of any house or part thereof, or of any articles therein, would tend to prevent or check infectious disease, it is the duty of the

local authority to give notice to the owner or occupier of the house in question requiring him to do the necessary work within a specified time. The person on whom the notice is served is liable on default to a penalty of 1*s.* to 10*s.* for every day during which he continues to make default; and the local authority is required to execute the necessary work, and recover the expenses incurred from the responsible parties.

If from poverty or other reason the person responsible is unable to carry out the requirements of the local authority, the latter may, with his consent, carry out the necessary work at their own expense (sec. 120).

Any local authority may direct the destruction of any bedding, clothing, etc., which have been exposed to infection from any dangerous infectious disease, and may give compensation for the same (sec. 121).

The local authority may provide a proper place, with all necessary apparatus and attendance for the disinfection of bedding, etc., and may there disinfect any articles free of charge (sec. 122).

They may also provide and maintain a carriage suitable for the conveyance of infectious patients, and pay the cost of conveyance of such patients to a hospital or elsewhere (sec. 123).

Any person suffering from a dangerous infectious disorder, who is without proper lodging or accommodation, or lodged in a room occupied by more than one family, or is on board any ship or vessel, or who is lodged in any common lodging-house, may, on the certificate of a legally qualified medical practitioner, be removed by order of any justice to any suitable hospital or place provided within a convenient distance. Any person wilfully disobeying or obstructing the execution of this order is liable to a penalty not exceeding £10 (sec. 124).

Regulations may also be made by any local authority for removing to a hospital persons brought within their district by any ship or boat, who are infected with a dangerous infectious disorder (sec. 125).

Any person who—

1. While suffering from any dangerous infectious disorder wilfully exposes himself without proper precautions in any street, public place, shop, inn, or public conveyance, or enters any public conveyance without previously notifying to the owner, conductor, or driver that he is so suffering; or—

2. Being in charge of any person so suffering, so exposes such sufferer; or—

3. Gives, lends, sells, transmits, or exposes, without previous disinfection, any bedding, clothing, rags, or other things which have been exposed to infection—

Is liable to a penalty not exceeding £5, and must also pay the amount of any loss or expense incurred in disinfecting the public conveyance which has been entered.

Every owner or driver of a public conveyance must immediately provide for its disinfection after it has been used to his knowledge by an infectious person, or is liable to a penalty not exceeding £5 (sec. 127).

Any person knowingly letting for hire any house or part thereof in which has been any person suffering from infectious disease, without proper disinfection to the satisfaction of a qualified medical practitioner, is liable to a penalty not exceeding £20 (sec. 128).

Any person who when letting a house or part thereof for hire, knowingly makes a false answer as to the occurrence of a case of infectious disease within six weeks previously, is liable to a penalty not exceeding £20, or to imprisonment not exceeding one month (sec. 129).

The Local Government Board may make and modify regulations for the treatment of persons affected with cholera or any other epidemic disease, and for the prevention of their spread, whether on water or land, and may prescribe by what authorities these regulations shall be enforced. Publication of such regulations in the *London Gazette* shall be regarded as conclusive evidence of such regulations (sec. 130).

Hospitals for Infectious Diseases.—Any local authority may build hospitals or temporary places for the reception of the sick belonging to their district, or may contract with any person for the reception of the sick. Two or more authorities may combine in providing a common hospital (sec. 131).

The expenses incurred in maintaining a patient who is not a pauper in such a hospital or place may be recovered from the patient at any time within six months of his discharge (sec. 132).

Any local authority may, with the sanction of the Local Government Board, provide or contract with any person to provide a temporary supply of medicine and medical assistance for the poorer inhabitants of their district (sec. 133).

Prevention of Epidemic Diseases.—Whenever any part of England appears to be threatened or is affected by any formidable infectious disease the Local Government Board may make and modify regulations for—

1. The speedy interment of the dead ;
2. House to house visitation ;
3. The provision of medical aid and accommodation, the promotion of cleansing, ventilation, and disinfection, and guarding against the spread of disease ;

And may declare these regulations to be in force in any district, and to apply to any waters within English jurisdictions (sec. 134).

The local authority within whose district the above regulations are in force shall see to their execution, and appoint the necessary officers for this purpose (sec. 136).

The local authority and their officers shall have power of entry on all premises or vessels for the purpose of executing such regulations (sec. 137).

The Local Government Board may, if they think fit, require two or more local authorities to act together for the purposes of these provisions relating to the prevention ef epidemic diseases (sec. 139).

A penalty not exceeding £5 is incurred by any person who wilfully

violates any of the regulations issued by the Local Government Board, or wilfully obstructs the carrying out of these regulations (sec. 140).

Mortuaries.—Any local authority may, and if required by the Local Government Board shall, provide and fit up a mortuary, and may make bye-laws for its management (sec. 141).

Where the body of any one who has died of any infectious disease is retained in a room in which persons live or sleep, or where any dead body is in such a state as to endanger the inmates of the house or room in which it is retained, any justice may, on the strength of a certificate signed by a legally qualified medical practitioner, order the body to be removed, at the cost of the local authority, to any mortuary provided by them, and order its burial within a specified time. If the friends or relations of the deceased do not undertake the burial of the body within the time specified, it is the duty of the relieving officer to bury the body, but the expense may be recovered from the person legally liable to pay the expense of the burial (sec. 142).

Regulation of Streets and Buildings.—The local authority in urban districts is responsible for keeping all public streets properly paved and repaired (sec. 149). They may also require the owners of any private street (not being a highway repairable by the inhabitants at large) to sewer, level, and pave such street at their joint expense (sec. 150).

Private streets after being thus sewered, etc., may be taken over by the local authority and declared to be public highways, but then become repairable by the inhabitants at large (sec. 152).

An urban authority may purchase any premises for widening or otherwise improving any street, or with the consent of the Local Government Board for the purpose of making any new street (sec. 154).

Buildings in an urban district are not allowed to be brought forward beyond the front wall of the adjoining houses without the written consent of the local authority (sec. 156).

Every urban authority may make bye-laws with respect to—

1. The level, width, and construction of new streets, and the provisions for their sewerage;

2. The structure of walls, foundations, roofs and chimneys of new buildings for securing stability and the prevention of fires, and for purposes of health;

3. The sufficiency of the space about buildings to secure a free circulation of air, and the ventilation of buildings;

4. The drainage of buildings, water-closets, earth-closets, privies, ash-pits and cesspools in connection with buildings, and the closing of buildings or parts of buildings unfit for human habitation, and the prohibition of their use for such habitation;

And may adopt provisions for securing the deposit of plans and sections by persons intending to build, and for securing efficient inspection (sec. 157).

When any work is commenced after notice of disapproval by the local

authority of plans submitted, and is in any respect not in conformity with the bye-laws in force, the authority may cause so much of the work as has been executed to be pulled down or removed (sec. 158).

The re-erecting of any building pulled down to or below the ground-floor brings it within the scope of the bye-laws relating to new buildings (sec. 159).

Lighting of Streets.—Urban authorities may contract with any person for the supply of gas or other means of lighting the streets, markets and public buildings in their district, or may themselves undertake the supply of gas for public and private purposes (sec. 161).

Public Pleasure Grounds.—Urban authorities may purchase, lay out and maintain lands for public walks or pleasure grounds, and may make bye-laws for their regulation (sec. 164). They may also provide such public clocks as they consider necessary (sec. 165).

Markets and Slaughter-Houses.—Urban authorities are empowered to provide market-places, with convenient approaches, places for weighing carts, and all appurtenant matters for the convenient use of such markets (sec. 166).

They may also provide public abattoirs, for the regulation of which they must make bye-laws (sec. 169).

The proprietors of private slaughter-houses licensed under this Act are obliged to place a conspicuous notice over their buildings, consisting of the words, "Registered Slaughter-house" (sec. 170).

Police Regulations.—Local authorities have power to make regulations—

1. To prevent obstructions and nuisances in the streets;
2. For the prevention of fires;
3. With respect to places of public resort,
4. Hackney carriages, and
5. Public bathing (sec. 171).

Bye-laws.—In addition to the preceding enactments local authorities may make and enforce bye-laws, confirmation by the Local Government Board being required in most cases before the bye-laws can be enforced (sec. 183–4).

Such bye-laws must be in harmony with the general laws of the country; they must be certain and determinate, and likewise reasonable. A bye-law which is repugnant to the provisions of the Public Health Act is invalid (sec. 315). Bye-laws are intended to supplement and not to vary or supersede the express provisions of statute law.

Any urban or rural sanitary authority may make bye-laws—

1. For the cleansing of pavements, removal of house refuse, cleansing of ash-pits, etc. (see p. 71).
2. For the regulation of common lodging-houses (p. 89).
3. For securing the decent lodging and accommodation of persons engaged in hop-picking or in the picking of fruit and vegetables within their district.

4. For the regulation of houses let in lodgings (p. 28).

Urban sanitary authorities may, in addition, make bye-laws—

1. For the removal of filth, snow, etc., and as to the keeping of animals (p. 72).

2. As to the erection of new buildings (p. 73).

3. For regulating private or public slaughter-houses (p. 93).

4. For the regulation of offensive trades (p. 30); and

5. For the regulation of parks and pleasure grounds (p. 34.)

Penalties not exceeding £5 for each offence may be imposed on offenders against any of these bye-laws (sec. 183).

Alteration of Areas.—The Local Government Board may, by provisional order, merge one district into another, or alter the boundaries of neighbouring districts (sec. 270). It may also form several districts into a united district for any of the following purposes: (1) the procuring of a common supply of water; (2) the carrying into effect of a system of sewerage for the use of all such districts; or (3) for any other purposes of this Act (sec. 279).

Two or more local authorities may combine for the purpose of establishing and maintaining a common hospital, and for undertaking great public works, such as water supply and sewerage.

The Local Government Board may authorise several districts to combine for the appointment of a joint Medical Officer of Health (sec. 286).

Port Sanitary Authorities.—The Local Government Board appoints the sanitary authorities of ports from the neighbouring local authorities (sec. 287). The port sanitary authority may delegate its powers to any riparian authority within or bordering on their district. The lord mayor and common council of the city of London form the port sanitary authority of the port of London (sec. 291).

The *General Order of the Local Government Board for preventing the spread of Cholera* (12th July, 1883) contains the following regulations:—

1. Every ship is deemed infected with cholera in which there is or has been during the voyage, or during the stay of the ship in a port in the course of the voyage, any case of cholera.

Regulations as to Detention.—2. If any officer of customs, on the arrival of a ship, ascertain or has reason to suspect that the ship is infected with cholera, he shall detain the ship, and order it to be moored or anchored in such a position as he shall direct.

3. No person must leave the ship while thus detained.

4. The officer thus detaining any ship must give immediate notice to the sanitary officer of the place where the ship is detained.

5. Such detention shall cease as soon as the ship has been duly visited and examined by the Medical Officer of Health; or if the ship is found to be infected with cholera, as soon as it has been moored and anchored in pursuance of Art. 10 of this Order. The examination must be commenced within twelve hours of the giving of the notice as aforesaid; otherwise the ship shall be released from detention.

Regulations as to Sanitary Authorities.—6. Port sanitary authorities and other sanitary authorities within whose district persons are likely to be landed from any ship coming foreign shall fix some place within their district where any ship may be moored or anchored for the purpose of Art. 10, and shall make provision for the reception of patients under Arts. 13 and 14.

7. The sanitary authority, on receiving notice from the customs officer, shall forthwith cause the ship to be examined by their Medical Officer of Health.

8. The Medical Officer of Health, if he has reason to believe that any ship within the district of the sanitary authority, whether examined by the customs officer or not, is infected with cholera, shall, or if she has come from a place infected with cholera, may visit and examine such ship. The master of the ship is obliged to permit the examination.

9. If, on making his examination, the Medical Officer of Health is of opinion that the ship is infected, he shall certify the same in writing both to the master of the ship and to the sanitary authority.

10. The master of any ship so certified to be infected with cholera shall moor his vessel at the place fixed for that purpose under Art. 6, and she shall remain there until the requirements of this Order have been duly fulfilled.

11. No person shall leave such vessel until the examination mentioned in Art. 12 has been made.

12. The Medical Officer of Health shall as soon as possible after the ship has been certified to be infected with cholera examine all persons on board, and all persons not certified to be suffering from cholera (Art. 13) shall be permitted to land immediately on giving their names and the places of their destination.[1]

13. Every person certified by the Medical Officer of Health to be suffering from cholera shall be removed to some hospital or place provided for the purpose, whence he cannot be removed until certified by the Medical Officer of Health to be free from the disease.

If the person suffering from cholera cannot be removed, the ship shall remain subject to the control of the Medical Officer of Health.

14. Any person certified by the Medical Officer of Health to be suffering from any illness which he suspects may prove to be cholera may be detained on board for a period not exceeding two days, or be detained in some hospital for a like period, in order that it may be ascertained whether the disease is or is not cholera. If found to be so suffering, he is to be dealt with under Art. 13.

15. The Medical Officer of Health shall in the case of every ship certified to be infected give directions and take the necessary steps for preventing the spread of infection, and the master of the ship is bound to carry into effect such directions.

16. If a death from cholera occurs on a ship while detained the master of the ship shall carry out the directions of the Medical Officer of Health as to burial.

[1] By an amended order of the Local Government Board, dated 29th Aug., 1892, it is provided that no person shall be permitted to land from such a ship "unless he satisfy the Medical Officer of Health as to his name, place of destination, and address at such place.'

17. All articles soiled with cholera discharges must be destroyed, and all clothing and bedding shall be destroyed or disinfected.

18. The ship must be disinfected, and every article therein, according to the directions of the Medical Officer of Health.

Importation of Rags.—An order of the Local Government Board was issued September 4th, 1890, prohibiting until the end of the same year the landing in any port or place in England and Wales of rags from Spain, owing to the prevalence in that country of cholera. This order has also been enforced on previous occasions; the place from which the importation of rags is forbidden being varied in accordance with the known prevalence of cholera.

OTHER SANITARY LAWS.

The sanitary enactments not comprised in the Public Health Act, 1875, are briefly summarised as follows:—

The Rivers Pollution Prevention Act, 1876.—*Law as to Solid Matters.*—Every person adding to or allowing to fall into any stream the solid refuse of any manufactory, manufacturing process or quarry, or any rubbish or cinders, or other waste or putrid solid matter commits an offence against this Act (sec. 2).

Law as to Sewage Pollutions.—Every person causing to flow or knowingly allowing to flow into any stream any solid or liquid sewage matter commits an offence against this Act (sec. 3).

Where sewage matter enters the stream along a channel in use before the passing of this Act an offence is not deemed to be committed against this Act, if the offender shows to the satisfaction of the court before whom the matter comes that he is using the best practicable and available means to render the sewage matter harmless. The Local Government Board may also, after local inquiry, allow additional time to enable any sanitary authority to make their sewage effluents harmless (sec. 3).

Law as to Manufacturing and Mining Pollutions.—The passage of poisonous, noxious, or polluting liquids from factories or manufacturing processes or from mines is deemed an offence against this Act, with the same exceptions as in the case of sewage pollutions (secs. 4 and 5).

Proceedings are only to be taken in the case of the last class of pollutions, except by the sanitary authority, except after complaint by any aggrieved person to and a local inquiry held by the Local Government Board (sec. 6).

Administration of the Act.—Sanitary authorities are bound to allow manufacturers to carry their effluent fluids into the sewers, unless this would injure them or prejudicially affect the disposal of the sewage on land, etc., or unless the sewers are insufficient for the purpose (sec. 7).

Every sanitary authority may enforce the provisions of this Act when a stream passes through their district, even if the offence is committed outside the district (sec. 8).

The mode of procedure adopted in this Act is somewhat cumbrous, and in practice, partly owing to the inertness of sanitary authorities, and partly

owing to the low standard of purity which is enforced, the Act has been in large measure a dead letter.

Sale of Food and Drugs Act, 1875–79.—No person shall mix, colour, stain, or powder, or permit any other person to mix, etc. (with the intention of selling), any article of food with any ingredient so as to render the article injurious to health, under a penalty not exceeding £50 for the first offence, and afterwards punishable by a maximum imprisonment of six months, with hard labour (sec. 3). The same enactment is made for drugs (sec. 4).

Exemption may be claimed in both cases, if the defendant shows to the satisfaction of the court that he possessed no knowledge of the admixture, and could not with reasonable diligence have obtained such knowledge (sec. 5).

No person shall sell to the prejudice of the purchaser any article of food or drug which is not of the nature, substance and quality of the article asked for, under a penalty not exceeding £20, provided that no offence is committed under this section (1) where any ingredient not injurious to health is added to produce an article of commerce, and not fraudulently to increase its weight; (2) where the drug or food is a proprietary article; (3) or in the case of compound drugs or foods.

It is no defence in a prosecution under this Act for the defendant to allege that the purchaser, having bought only for analysis, was not prejudiced by the sale.

The vendor is protected from the consequences of selling a drug or food containing foreign ingredients not injurious to health if at the time of delivery of such article he supplies a printed label on the article to the effect that it is mixed (secs. 8 and 9).

Local authorities may, and when required to do so by the Local Government Board shall, appoint public analysts for their districts. No analyst can be appointed without the consent of the Local Government Board, and no person locally engaged in the sale of food or drugs (sec. 10).

Any private person may have any article which he has purchased analysed at an expense not exceeding half a guinea (sec. 12).

An officer, generally a sanitary inspector, is appointed by the local authority to purchase samples of food and drugs for analysis (sec. 13). On purchasing any article for this purpose the officer shall, after having completed the purchase, inform the vendor of his intention of having the same analysed by the public analyst, and shall offer to immediately divide the article into three parts, each to be sealed up. One of these he gives to the vendor, one he takes to the public analyst, and one he retains for future comparison (sec. 14).

If the vendor do not accept the offer to have one sample, the officer shall divide the article into two parts, one to be taken to the analyst, and one to be retained by himself for comparison (sec. 15). The parcel may be sent to the analyst through the post-office as a registered letter if necessary (sec. 16).

Any person refusing to sell to an officer any article exposed for sale is liable to a penalty not exceeding £10 (sec. 17).

The analyst is required to furnish a certificate of each analysis, and if it shows that an offence has been committed, proceedings may then be taken before a court of summary jurisdiction (sec. 20).

The certificate of the analyst is *primâ facie* evidence of adulteration, but the defendant may, if he wish, require the analyst to be called as a witness (sec. 21). The court may, if they think fit, upon the request of either party, cause any article of food or drug to be sent to the Commissioners of Inland Revenue, who shall direct the chemical officers of their department at Somerset House to make the analysis, and give a certificate to the justices of the result of the analysis (sec. 22).

In any prosecution under this Act the onus rests with the defendant to prove that he is protected by any exception or provision of this Act (sec. 24).

The defendant must be discharged if he proves that he bought the article in the same state as sold, and with a warranty (sec. 25).

All tea imported and landed at any port in Great Britain or Ireland shall be subject to examination by the officers of the Customs; and if such tea is found to be mixed with other substances or exhausted tea, it shall not be delivered unless with the sanction of the Commissioners of Customs, and on such conditions as they direct. If in the opinion of the analyst the tea is unfit for human food, it shall be destroyed (sec. 30).

The Amendment Act of 1879 gives the officer of the local authority power to procure any sample of any milk in course of delivery to the purchaser or consignee, and to submit the same to be analysed as under sec. 13 of the principal Act (sec. 3). A penalty is imposed for refusal to furnish a sample of milk under such circumstances (sec. 4).

Samples of any article of food or any drug may be purchased for analysis in any street or place of public resort, as well as in any shop or stores (sec. 5).

Sec. 6 specifies that in any action for selling to the prejudice of the purchaser spirits not adulterated otherwise than by the admixture of water, it shall be a good defence to prove that the admixture has not reduced the spirit more than 25 degrees under proof for brandy, spirit, or rum, or 35 degrees under proof for gin (sec. 6).

Dairies, Cow-sheds, and Milk-shops Order of 1885.—This Order makes it unlawful for any person to carry on the trade of cowkeeper, dairyman, or purveyor of milk unless he is registered by the local authority.

The local authority must keep and at intervals revise their register of such persons. No person is allowed to begin to occupy a building as a dairy or cow-shed unless he makes provision to the reasonable satisfaction of the local authority for its lighting and ventilation, including air-space and cleansing, drainage and water supply; and he must give one month's notice in writing to the local authority of his intention to occupy the building.

All dairies and cow-sheds, whether new or not, can only be occupied so long as the lighting, ventilation, including air-space, and the cleansing, drainage, and water-supply are such as are necessary or proper—

(*a*) For the health and good condition of the cattle therein; and

(*b*) For the cleanliness of all milk-vessels used therein; and

(*c*) For the protection of the milk against infection or contamination.

It is unlawful for any person following the trade of cowkeeper or dairyman, or purveyor of milk, or being the occupier of a milk-store or milk, shop—

(*a*) To allow any person suffering from a dangerous infectious disorder, or having been recently in contact with such a person, to milk cows or handle milk-vessels, or in any other way to help in connection with the preparation or sale of milk; or (*b*) still less himself to offend in a similar way.

No water-closet, privy, urinal, etc., is allowed to communicate with any dairy or milk-store; and the milk-store must not be used as a sleeping apartment, or for any other purpose incompatible with the cleanliness of the milk. Pigs are not allowed to be kept in a cow-shed.

Local authorities may make regulations for (*a*) the inspection of cattle in dairies; (*b*) for prescribing and regulating the lighting, ventilation, cleansing, draining, and water-supply of dairies and cowsheds; (3) for securing the cleanliness of milk-stores and shops and of milk-vessels; (4) for prescribing precautions to be taken against infection or contamination.

The milk of a diseased cow shall (*a*) not be mixed with other milk nor (*b*) sold or used for human food; and shall not (*c*) be used for the food of swine or other animals until it has been boiled.

Regulation of Bakehouses.—The regulations on this subject are contained in the Factory and Workshops Acts of 1878 and 1883. Bakehouses are defined as "any places in which are baked bread, biscuits, or confectionery, from the baking or selling of which a profit is derived."

Where a bakehouse is situated in a town containing over 5,000 persons at the last census, all the inside walls and ceilings of its rooms, and all the passages and staircases shall be painted with oil or varnished with three coats, to be renewed once at least in every seven years, and washed with hot water and soap once at least in every six months; or shall be limewashed once at least in every six months (sec. 38, Act of 1878).

In similar bakehouses, a room on the same level as the bakehouse, and forming part of the same building, shall not be used as a sleeping place, unless it is effectually separated by a partition from the floor to the ceiling; and unless it has an external glazed window of at least 9 sq. feet in area, of which one-half is made to open for ventilation (sec. 35, Act of 1878). Penalties are incurred by infringing either of these regulations.

It is not lawful to let, or occupy as a bake-house, any room not so let before 1st June, 1883, unless it fulfils the following regulations:—

1. No water-closet, privy, or ash-pit shall communicate directly with the bakehouse;

2. Any cistern for supplying water to the bakehouse shall be separate and distinct from the cistern supplying water for the water-closet;

3. No drain or pipe for carrying off sewage matter, shall have an opening within the bake-house (sec. 15, Act of 1883).

The occupier of any bakehouse whatever, is liable to a penalty, if the inspector of the local authority satisfies a court of summary jurisdiction that the bakehouse is, on sanitary grounds, unfit for a bakehouse (sec. 16, Act of 1883).

The Medical Officer of Health, for the purposes of these sections, has all the powers of an Inspector under the Factory and Workshop Act, 1878.

The Alkali Works Regulation Acts, 1881.—In this Act, "alkali work" means every work for the maufacture of alkali, sulphate of soda or potash, in which hydrochloric acid is evolved; and for the purpose of this definition the formation of any sulphate in the treatment of copper ores by common salt or other chlorides, is to be deemed to be a manufacture of sulphate of soda.

Every alkali work must condense, to the satisfaction of the Inspector, 95 per cent. of the hydrochloric acid evolved, and there must not be in each cubic foot of chimney gases more than $\frac{1}{5}$ grain of H Cl.

The acid fumes of sulphur and nitrogen evolved in the process of manufacturing sulphuric acid or sulphates, must not escape from the chimneys, so as to exceed in each cubic foot of the chimney gases what is equivalent to four grains of $S O_2$. A penalty of £50 for the first offence and £100 as a maximum for subsequent offences, is incurred by contravention of this section (sec. 3).

The owner of every alkali work is bound in addition to use the best practicable means for preventing the discharge of noxious and offensive gases (sec. 4).

Acid drainage must not be allowed to come in contact with alkali waste so as to cause a nuisance (sec. 5).

Alkali waste must not be deposited without using the best practicable means for preventing nuisance; and after the deposit of such waste, the best practicable means for abating nuisance must be employed by the owner, on receiving a notice from the Inspector (sec. 6 and 7).

Sulphuric acid works must be so carried on that the acid gases of sulphur and nitrogen evolved in the manufacture, do not exceed what is equivalent to four grains of $S O_3$, in every cubic foot of escaping gases.

The owners of sulphuric acid works, chemical manure works, gas liquor works, nitric acid works, sulphate or chloride of ammonia works, and chlorine or bleaching powder works, must use the best practicable means for preventing the discharge of offensive gases, the limits fixed being as above.

The Inspector, ten days before taking action for a nuisance under this Act, must lay before the owners a statement of the defects, and a specification of the best means for preventing it.

Owners are liable for any nuisance produced, unless they can prove that

they have used all reasonable care, or that the offence was committed by some servant without their knowledge, in which case the servant shall be liable.

All alkali works must be registered, and the Local Government Board appoints Inspectors under this Act. The Inspector may visit the works at any time, and may demand to see a plan of the condensing apparatus, but must keep it secret. The Chief Inspector shall, before the 1st March in each year, present a report to the Local Government Board of the proceedings of all the Inspectors under this Act, which must be laid before both Houses of Parliament.

Housing of the Working Classes Act, 1890.—This Act consolidates and amends a number of previous Acts on the same subject. It is applicable throughout the United Kingdom, its object being to secure the closure and if necessary the demolition of insanitary, and their replacement by sanitary, dwellings.

Unhealthy Areas are dealt with in Part I. of the Act. It is the duty of the Medical Officer of Health to make an official representation to his local authority when he finds that either (*a*) any houses, courts, or alleys, are unfit for human habitation, or (*b*) the narrowness, closeness, and bad arrangement or the bad condition of the streets and houses or groups of houses within an area, or the want of light, air, ventilation, or proper conveniences, or any other sanitary defects, make the given area dangerous or injurious to the health of the inhabitants of the area or of their neighbours; and that the evils connected with such houses, courts, or alleys, cannot be effectually remedied otherwise than by an improvement scheme for their rearrangement and reconstruction.

The local authority, if satisfied of the truth of the representation, and of the sufficiency of their resources, are required to make a scheme for the improvement of the area (sec. 4).

The Medical Officer of Health is required on complaint from ratepayers to report on the condition of any area complained of as being unhealthy (sec. 5).

The improvement scheme of a local authority must provide for the rehousing of all members of the working classes displaced by it.

The scheme requires confirmation by the Local Government Board, and the local authority must carry out the scheme when thus confirmed.

In assessing the compensation to be paid to the owners of houses within the condemned area, deductions are made for any state of defective sanitation; and where a house cannot reasonably be made fit for human habitation, only the value of the land and of the materials of the building thereon need be paid (sec. 21).

Part II. deals with *Unhealthy Dwelling-Houses.* It lays on the Medical Officer of Health of every district the duty of representing to the local authority any dwelling-house which appears to him in a state so dangerous or injurious to health as to be unfit for human habitation, and he may also be called upon for a representation on complaint of householders (sec. 30, 31).

The local authority are required to cause to be made from time to time inspection of their district, with a view to ascertain whether any dwelling-house is unfit for human habitation, and they must forthwith take the necessary proceedings, before a justice, to obtain a closing order for such dwelling-house, on receiving a representation from their officer (sec. 32).

When a closing order has been made, and the local authority is of opinion that the dwelling-house has not been rendered fit for human habitation, they may order the demolition of the building, time being given for the owner to attend and state his objections (sec. 33).

If a Medical Officer of Health finds that any building within his district, although not in itself unfit for human habitation, either stops ventilation or otherwise conduces to make other buildings unfit for human habitation, or prevents proper measures from being taken to remedy nuisances, it is his duty to represent the facts to his local authority, who shall order the demolition of the obstructive building, after compensating the owner (sec. 38).

Local authorities may themselves build dwelling-houses for the working classes, or may purchase existing houses, and make bye-laws for their regulation.

Public Health (Water) Act, 1878.—This act amends the Public Health Act of 1875 so far as it relates to the supply of water. It makes it the duty of every rural sanitary authority to see that every occupied dwelling-house within their district has within a reasonable distance an available and sufficient supply of wholesome water.

If the Medical Officer of Health or Sanitary Inspector reports that a house is without such a supply, and the authority are of opinion that the supply can be provided at a reasonable cost, they shall—

(*a*) Serve on the owner a notice requiring him, within a specified time, to provide a water supply.

(*b*) At the expiration of this time, if the notice is not complied with, the local authority may serve another notice on the owner, stating that if the requirements of the first notice are not complied with within a month, they will provide such supply, and recover the expense from the owner (sec. 3).

The provisions of this section are specially stated not to exempt the authority from the duty imposed upon them by the Public Health Act, 1875, of providing their district with a supply of water in cases where danger arises to the health of the inhabitants of the district from the insufficiency or unwholesomeness of the existing supply, and a general scheme of supply is required, and such supply can be got at a reasonable cost.

It is not lawful in any rural district for the owner of any dwelling-house, which may be erected after the date of the commencement of this Act, or, of any dwelling-house which after that date has been pulled down to the ground floor and rebuilt, to allow the same to be occupied without having obtained a certificate from the sanitary authority, that a sufficient supply of wholesome water is available (sec. 6).

It is the duty of every rural sanitary authority, from time to time, to ascertain the condition of the water supply within their district, and to take all the necessary steps for this purpose (sec. 7).

The Gas Works Clauses Act, 1847, 1871.—The authority to establish a gas manufactory must be obtained from the Board of Trade. In order to obtain this authority, the undertakers must produce the written consent of the owners and occupiers of every dwelling-house within 300 yards of the limits of the site on which it is proposed to have the works.

The undertakers must provide any person with gas whose premises are within 25 yards of their mains. They are required also to provide a given quality of gas, and for this purpose to provide public testing-stations at which the luminosity of the gas and its freedom from sulphuretted hydrogen can be tested by official gas examiners appointed by the local authority.

The Factory and Workshop Acts, 1878, 1883, and 1891.—The Acts of 1878 and 1883 require that every factory shall be kept clean, and free from effluvia arising from any drain, water-closet, privy, or urinal, or other nuisance.

Overcrowding, so as to be dangerous or injurious to the health of the persons employed, is forbidden, and each factory must be ventilated, so as to render harmless, as far as practicable, all gases, vapours, dust, or other impurities generated in the process carried on in the factory.

The Inspector under the Act must give notice of sanitary defects in workshops and factories to the Local Sanitary Authority, who must take the action required in respect of them, under the law relating to public health.

Machinery which is dangerous must be properly fenced off.

Careful restrictions are enforced as to the cleaning of machinery in motion, especially in the case of young persons and children.

In *textile factories* the duration of the employment of women and young persons must be not more than from 6 to 6 or from 7 to 7, on Saturday until 1 or 2 p.m.; intervals, amounting to at least 2 hours, being allowed for meals.

A young person (*i.e.* from 14 to 18 years old) or women must not be employed continuously more than $4\frac{1}{2}$ hours without at least half-an-hour's interval for a meal.

Children (*i.e.* under 14 years of age) must only be employed half-time each day, or on alternate days, but a child aged 13 years who produces a certificate of having attained such a standard of efficiency as to satisfy the inspector authorised by the Education Department, shall be deemed a young person for the purposes of this Act.

In *non-textile factories* practically the same hours hold good.

In *workshops* women are not allowed to work longer than from 6 a.m. to 9 p.m, on Saturdays from 6 a.m. to 7 p.m.; at least $4\frac{1}{2}$ hours ($2\frac{1}{2}$ on Saturday) being allowed for meals.

No child under ten years of age is allowed to be employed in any factory or workshop (raised to eleven years by the Act of 1891).

A certificate of age and physical fitness for work from the certifying surgeon of the district must be obtained in the case of any child or young person under 16 years before he is employed a fortnight in any factory.

All cases of accident causing death or bodily injury must be reported to the Factory Inspector and to the certifying Surgeon, the latter of whom shall investigate and report on the causes of the accident.

For the special regulations of this Act relating to bakehouses, see p. 40.

The changes effected in factory legislation by the Factory and Workshop Act of 1891 may be gathered from the following circular addressed by the Local Government Board to the Town Councils and other Urban Sanitary Authorities, Sept. 30th, 1891.

THE FACTORY AND WORKSHOP ACT, 1891 (54 & 55 Vict., c. 75).

This Act has been passed to amend the law relating to Factories and Workshops.

The most important provisions which it contains, so far as it affects Sanitary Authorities, are those which relate to workshops, the sanitary regulation of which it places under the direct control of the sanitary authorities, instead of that of the Inspector of Factories. These provisions will come into operation on the 1st of January next (section 40).

It is provided by section 91 of the Public Health Act, 1875, as amended by section 107 of the Factory and Workshop Act, 1871 (41 Vict. c. 16), that any factory, workshop, or workplace not kept in a cleanly state, or not ventilated in such a manner as to render harmless, as far as practicable, any gases, dust, or other impurities generated in the course of the work carried on therein that are a nuisance or injurious to health, or so overcrowded while work is carried on as to be dangerous or injurious to the health of those employed therein, shall be deemed to be a nuisance liable to be dealt with summarily in manner provided by the Public Health Act.

Section 101 of the Factory and Workshops Act, 1878, however, directed that this provision should not apply to a factory or workshop subject to the provisions of that Act relating to cleanliness, ventilation, and overcrowding.

The words "or workshops" in the last-mentioned section are repealed by section 39 of the new Act, and the effect of this is to make the provision in section 91 of the Public Health Act above referred to applicable to workshops generally, instead of only to those not now subject to the Factory and Workshop Act, 1878; and it will be the duty of the Sanitary Authority to enforce that provision accordingly.

The new Act also provides that sections 3 and 33 of the Factory and Workshop Act, 1878, which relate to cleanliness, ventilation, and overcrowding in, and lime-washing of, factories and workshops, shall cease to apply to workshops. (Sections 3 (1) and 39.) These matters must, therefore, now be dealt with under the Public Health Act or under the powers conferred by section 4 of the new Act.

That section provides that every workshop as defined by the Factory and Workshop Act, 1878, including any workshop conducted on the system of not employing any child, young person, or woman therein, and every workplace within the meaning of the Public Health Act, 1875, shall be kept free from effluvia arising from any drain, water-closet, earth-closet, privy, urinal, or other nuisance, and unless it is so kept it is to be deemed to be a nuisance liable to be dealt with summarily under the law relating to public health. (Sub-section (1).)

The definition of "workshop" in section 93 of the Act of 1878 is too lengthy to be inserted here, but one point in connection with it may be mentioned. The section directs that a place solely used as a dwelling shall not be deemed to form part of a workshop for the Act. By section 31 of the new Act, in lieu of this it is provided that a room

solely used for the purpose of sleeping therein shall not be deemed to form part of a workshop for those purposes.

Section 4 also provides that where, on the certificate of a Medical Officer of Health or Inspector of Nuisances, it appears to the Sanitary Authority that the lime-washing, cleansing, or purifying of a workshop, or of any part of it, is necessary for the health of the persons employed therein, the Sanitary Authority shall give notice to the owner or occupier, requiring him to do the work (sub-section (2)); and that if he fails to comply with the notice within the time specified therein, he shall be liable to a fine not exceeding 10*s*. for every day during which he continues to make default, and the Sanitary Authority may, if they think fit, do the work themselves, and may recover from him, in a summary manner, the expenses incurred by them in so doing. (Sub-section (3).)

For the purpose of their duties with respect to workshops, the Sanitary Authority and their officers, without prejudice to their other powers, are to have all such powers of entry, inspection, taking legal proceedings, or otherwise, as an Inspector of Factories has under the Act of 1878. (Section 3 (2).)

As regards these powers attention may be called to Part III. of the Act of 1878, and especially to section 68. It has hitherto been necessary, under section 69 of that Act, that in certain cases the Inspector of Factories should obtain authority from a Secretary of State, or a warrant of justices, before entering a workshop, but it is now expressly provided by the new Act that the powers of entry conferred by section 68 of the Act of 1878 on an Inspector of Factories may be exercised without the authority or warrant required in certain cases by section 69, and the latter section is repealed. (Sections 25 and 39.)

The powers of the Sanitary Authority under section 68 of the Act of 1878 will be in addition to those which they now possess under section 102 of the Public Health Act, 1875.

If any child, young person, or woman is employed in a workshop, and the Medical Officer of the Sanitary Authority becomes aware of it, section 3 (3) of the new Act requires him forthwith to give notice of the fact to the Inspector of Factories for the district. This provision should be brought under the notice of the Medical Officer of Health by the sanitary authority. By section 96 of the Act of 1878, the term "child" is defined as meaning a person under the age of 14 years, a "young person" as meaning a person of the age of 14 years and under the age of 18 years, and a "woman" as a woman of 18 years of age or upwards.

Section 4 of the Factory and Workshop Act, 1878, provides that where it appears to an Inspector of Factories that any act or default in relation to any drain, water-closet, earth-closet, privy, ash-pit, water-supply, nuisance, or other matter in a factory or workshop is punishable or remediable under the law relating to public health, but not under that Act, the Inspector shall give notice to the sanitary authority, and that on such notice being given it shall be the duty of the sanitary authority to make such inquiry and take such action as may be proper for the enforcement of the law. For the purposes of the section, the Inspector of Factories may take with him into the factory or workshop a Medical Officer of Health, Inspector of Nuisances, or other officer of the Sanitary Authority. The new Act will apply this enactment to workshops conducted on the system of not employing any child, young person, or women therein, and also to laundries. (Section 2 (1).)

The Act of 1891 further provides that where an Inspector of Factories has given notice to the sanitary authority, under section 4 of the Act of 1878, as amended, and proceedings are not taken within a reasonable time for punishing or remedying the act, neglect, or default referred to in the notice, the Inspector may take the like proceedings for this purpose as the Sanitary Authority might have taken. He will be entitled to recover from the Sanitary Authority all such expenses as he may incur and are not recovered from any other person, and have not been incurred in any unsuccessful proceedings. (Section 2 (2).)

Law respecting Mines (*Coal Mines Regulations Act*, 1872.—*Metalliferous Mines Regulation Acts*, 1872–75).—Children under 10 years of age and women or girls are not admitted to work in mines. Boys between 10 and 16 are only admitted under special restrictions. The owner of the mine must keep an exact register of his work-people, with their name, age, address, and hours of work.

In coal-mines each pit should have two shafts, separated by a thickness of at least 10 feet of the natural strata, and communicating by a gallery 4 feet wide and 3 feet high. It should in addition be provided with the necessary appliances for the descent and ascent of the workers.

No wages must be paid at a public-house or other place for the sale of intoxicating drinks.

The ventilation of mines must be adequate and uninterrupted.

In every mine in which inflammable gases have been found within twelve months, a competent person is required before the commencement of each day's work to inspect that part of the mine with a safety-lamp, and report the result in a book specially kept for the purpose. Only locked safety-lamps are allowed in any part of a mine in which there is likely to be an accumulation of inflammable gases.

Infant Life Protection Act, 1872.—It is unlawful for any one, without having her name and house registered, to take, for the sake of nursing for payment for over 24 hours, more than one infant under one year of age or two twins.

The local sanitary authority can only register such applicants if the house is in a sanitary condition, and if the woman appears to be competent to undertake her duties.

The keeper should enter in a special book the day on which the infant was brought to her, its name, age, and sex; the name and address of the parent or guardian, the day on which her charge ceases, and the name of the person fetching the infant away.

The sanitary authority fixes the number of infants that each keeper is entitled to receive.

The registration is only valid for a year, and can be withdrawn at any time, if it is discovered that the infants are badly cared for, or are for any reason under unfavourable conditions.

Any death occurring among the infants in a registered house should be notified to the police within 24 hours, in order that inquiries may be made.

The above requirements do not apply to parents, nor to charitable institutions, nor to persons under the control of an association for protecting infants.

Vaccination Acts, 1867, 1871, 1874.—Vaccination, which has been obligatory since 1853, is under the control of the Boards of Guardians. *Public Vaccinators* are appointed for various districts under each Board, and there is a *Vaccination Officer*, who looks up the defaulting parents, in order to secure the vaccination of their children.

The public Vaccinator must be a qualified medical practitioner, and must

have received special instruction in vaccination. He receives a fee for each person vaccinated, this being paid by the parochial authorities, not by the persons vaccinated. Special grants are made by the Local Government Board to successful vaccinators.

The public Vaccinator must record in the vaccination register the name, age, and dwelling of each infant, the date of vaccination, the source of the lymph, and the result of the operation. This register is presented at each meeting of the Board of Guardians.

The subjects vaccinated should be examined on the eighth day, and the result specially recorded. A certificate is required from a medical practitioner if the infant has had small-pox, or for some other reason cannot be vaccinated.

Every infant must, unless specially exempted, be vaccinated before reaching the age of three months.

Each month the vaccination officer ought to be supplied with a list of those born in his district, and of those dying under one year of age.

Twice a year the Vaccination Officer presents a report to the Board of Guardians on the carrying out of vaccination. A copy of this report is sent to the Local Government Board, which presents an annual report on the vaccination in the whole kingdom.

Ignorance of the law is no defence on the part of the parents. When the birth of the infant is registered, the registrar gives the parents a printed paper, acquainting them with the obligation to have the infant vaccinated, and indicating the times and place where public vaccination is carried on.

If the Vaccination Officer does not receive either from the public Vaccinator, or from a private medical practitioner, a certificate of successful vaccination within three months of the infant's birth, he inquires into the cause. If after a second warning, the neglect is continued, the matter is reported to the Board of Guardians, whose duty it is to bring the offending parents before a justice.

The Boards of Guardians, public Vaccinators and Vaccination Officers are under the control of the Local Government Board, which rigorously supervises the carrying out of the vaccination laws, and sends special Inspectors to control the efficiency of the vaccination.

Measures to be adopted on the appearance of Small-Pox in a locality.—The Vaccination Officer should give special attention to the localities in which the infection exists; the Guardians should instruct their district Medical Officers to give him the earliest notice of every fresh case of small-pox coming under their treatment. In districts where the compulsory notification of small-pox is in force the Medical Officer of Health will also use every endeavour to secure the vaccination or re-vaccination of unprotected persons.

The Vaccination Officer must use the utmost dispatch in securing the prompt vaccination of unprotected children in the infected locality. In the case of unvaccinated children under 3 months of age, he should urge the advisability of not waiting until the legal limit of age is reached.

He should also make it well known in infected localities that the public vaccinator will re-vaccinate all persons applying to him over twelve years of age, who have not before been successfully re-vaccinated.

The public vaccinators are required to give special daily attendances at the vaccination station for the vaccination of cases of urgency.

As far as possible, vaccination and re-vaccination should be at different hours, vaccination in urgent cases being done first.

Burial Regulations.—The enactments actually in force regulating burials are contained in old Sanitary Acts, the remaining parts of which have been repealed.

It is forbidden to make within an urban district a grave within the walls of, or underneath any church or other place of public worship, which has been built since the 31st August, 1848. Persons in charge of such vaults or graves already existing may be required by order of the Queen in Council to take all necessary steps for preventing them from being dangerous or injurious to the public health. For the protection of the public health, no new burial-ground can be opened within any city or town, and burials within any such existing burial-ground may be prohibited by order of the Queen in Council.

Where the vestry of any parish resolves to appoint a burial board, the local board may, if desired, be formed into a burial board.

Any urban authority constituted a burial board may take all the necessary steps for keeping the burial ground in repair, and may make bye-laws for this purpose.

Regulations as to Vessels (*Merchant Shipping Acts*, 1854–62–67–76. *Passengers Act*, 1855).—In addition to the enactments of the Public Health Act, 1875, ships are required to fulfil the following sanitary requirements :

No ship is allowed to carry under its poop or upper passenger deck more than 1 adult to every 15 clear superficial feet allotted to their use; or, on the lower passenger deck, more than 1 adult to every 18 superficial feet. provided that if the height is less than 7 feet, or if the apertures are less than 3 square feet to every 100 superficial feet of the lower passenger deck, there shall only be one adult to every 25 superficial feet. No ship is allowed to carry on the whole more than 1 adult to every 5 superficial feet clear for exercise on the upper deck or poop.

There must not be more than 2 tiers of berths on any one deck on a passenger ship, and there must be at least 6 inches between the floor of the berth and the deck beneath.

There must be a space of at least 2 feet 6 inches between each tier of berths. No part of any berth is allowed to be within 9 inches of any water-closet.

Single men must be berthed in separate compartments.

No passenger vessel can be launched without having been first officially declared fit for navigation, and the maximum number of passengers fixed.

The number of persons who may be lodged in the forecastle should be indicated over the entrance to it.

The ventilation of vessels should be sufficient; and no nuisance should be allowed from emanations of bilge-water or of cargo.

The selling of ardent spirits on board is forbidden.

The drinking water should be of good quality, and sufficient in amount.

On long voyages each person on merchant vessels must drink a daily allowance of lime-juice. Every vessel must be provisioned with bread, flour, rice, potatoes, fresh and preserved meat, lime-juice, tea, sugar, mustard, pepper, vinegar, salt, butter, fat, and dried raisins.

The officers of the Board of Trade are required to see that these regulations are carried out.

On every passenger vessel there should be at least two properly arranged water-closets.

Every vessel should have sufficient space allotted as a hospital.

Every passenger vessel must carry a medical man, when it is going on a voyage whose estimated duration exceeds 80 days in the case of a sailing vessel, or 45 days in the case of a steamer, when the number of passengers exceeds 50; and in any voyage exceeding a day in length when the passengers exceed 300.

In the absence of a doctor, instructions are given for the captain's guidance in cases of sickness. In these instructions captains are required to destroy the clothing and bedding of cholera patients before the ship enters an English port.

Where ships possess a doctor, it should be his duty not only to attend to the sick, but also to supervise and regulate the hygiene of the ship.

The Canal Boats Act, 1877 and 1884.—No canal boat can be used as a dwelling unless registered in accordance with this Act (Sect. 1). The Local Government Board are required to make regulations for registration, fixing the number of persons, promoting cleanliness, and preventing infectious diseases in such boats (sec. 2).

Power is given to sanitary authorities to cause inspection to be made of canal-boats (sec. 5).

The following are the chief sanitary regulations of the Local Government Board now in force under the Canal Boats Act.

Before being registered, a canal boat must fulfil the following among other conditions:—

(*a*) The interior of any after-cabin intended to be used as a dwelling, shall contain not less than 180 cubic feet of free air-space, and of any fore-cabin not less than 80 cubic feet of free air-space.

(*b*) Every cabin intended to be used as a dwelling must have sufficient means of ventilation independent of doors.

Not less than 60 cubic feet of air-space must be allowed for every person over the age of 12 years, and 40 cubic feet under 12.

A cabin used as a sleeping apartment by a husband and wife, must not at the same time be occupied by any girl above the age of 12, or any boy above the age of 14 years.

Bilge-water must be pumped out so as to prevent any accumulation.

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The cabins must be kept in a cleanly and habitable condition.

When any person on a canal boat is suffering from an infectious disease, the master of the boat shall inform the local sanitary authority of the fact. Where a canal boat has been detained for disinfection and cleansing, the Medical Officer of Health must supply to the master of the boat before it is allowed to leave, a certificate that this has been duly carried out.

The Prisons Act, 1865.—In everything relating to the hygiene of prisons, England has, in most respects, advanced beyond other nations, the only State which can compare with it on this score being Belgium.

It is to the great English philanthropist, John Howard, that the honour belongs of having, towards the end of last century, prepared the way for a more humane prison system, by making known the enormous mortality among prisoners, and pointing out its causes.

There are in England three kinds of prisons: prisons for the towns, counties and the State. In the last are detained persons condemned to the heaviest penalities. At the beginning, prisoners are isolated; afterwards they are permitted to take part in general work.

Those undergoing the cell discipline are occupied in weaving cloth for the prisoners' clothes, in making carpets, baskets, etc. The work done in common is in the State wood yards and quarries, or consists in levelling land, or making new roads, etc.

The food is confined to what is strictly necessary. In former times prisoners were permitted to procure for themselves food and enjoyments beyond the prison régime; but this is now forbidden.

The amount of nutriment contained in prison diets for persons undergoing more than four months' imprisonment, is shown in the following tables (given by B. Yeo):—

	For Men without Hard Labour and Women.	For Men with Hard Labour.
	ozs. grammes.	ozs. grammes.
Albuminates	3·23 or 91·5	4·09 or 116·0
Fats	1·00 ,, 28·35	1·30 ,, 37·0
Carbo-hydrates	15·57 ,, 440·0	20·17 ,, 572·0
Salts	1·27 ,, 36·00	1·55 ,, 44·0

Each prison has its governor and doctor, who control the order and good behaviour, the ventilation, and warming of the prison, and the preparation of food, etc.

Registration Acts, 1836, 1874.—The law of 1836 contains the regulations organizing a general register office of births, deaths, and marriages, and its local branches.

In accordance with this law, the country is divided into registration districts, each sub-divided into sub-districts. Every rural or urban district has a *registrar*, paid by the board of guardians, with local registrars under him.

The father or mother of a child must give notice to the registrar within

42 days of its birth, and sign the register in his presence. If no notice has been given within 42 days, the registrar may, by notice in writing, require any medical man or other person present at the birth to attend at his office and give the necessary information.

The following regulations are in force for the registration of deaths :—

It is obligatory on the parents of the deceased to give to the registrar information of the death within five days of its occurrence; or in their default, the same obligation devolves upon the nearest relatives of the deceased or other persons present at the death, or in attendance during the last illness. Failing these, the obligation rests upon a medical man who has been present at the death, to give information to the best of his knowledge and belief of the facts concerning the death to be registered.

Usually the medical practitioner's duty ceases when he has signed and given to some person required to give information concerning the death, a certificate, stating, to the best of his knowledge and belief, the name and age of the deceased, the date of death, the duration of the malady and cause of death. A penalty of 40*s.* may be inflicted on a practitioner, who, after having been in attendance during the last illness of the deceased, refuses or fails to give such a certificate. A penalty is also incurred for making a false certificate to the registrar.

If the cause of death is doubtful, or if no medical man has attended the deceased, or can certify as to the cause of death, it is the duty of the registrar to communicate the facts to the *coroner*, who will decide whether an *inquest* is necessary.

The registrar transmits a weekly return of the deaths within the district to the local sanitary authority, and is required to furnish an immediate return of deaths from contagious diseases or diarrhœa; being paid a sum of 2*d.* for each death, a return of which is thus made.

The following Acts of Parliament of hygienic importance have been passed in 1889–91.

The Infectious Disease (Notification) Act, 1889.—This Act is unfortunately an "adoptive" one, by vote of the Local Authorities, after public notice has been given; but already five-sixths of the population of England and Wales have adopted it, and there is reason to believe that it will be shortly made compulsory throughout the country. London was excepted from the "adoptive" scope of the Act, it coming into force in the Metropolis as soon as the Act became law. The obligation to notify each case of infectious disease rests on both the householder and the medical practitioner, but usually the latter alone notifies. The fact that the householder is also responsible prevents him from evading the responsibility of notification by not calling in a doctor.

Each medical practitioner attending on or called in to visit a patient, on becoming aware that the patient is suffering from an infectious disease to which the Act applies, must, in the following cases, forthwith send to the Medical Officer of Health for the District a certificate in the form prescribed by the Local Government Board (sections 3, 4) :—

THE INFECTIOUS DISEASE (NOTIFICATION) ACT, 1889.

Certificate of Medical Practitioner.

To the Medical Officer of Health.

I hereby certify and declare that in my opinion (*a*) an inmate of (*b*) is suffering from (*c*) Dated the day of 189

(Signed) Medical Practitioner.

N.B.—This Certificate must (under a penalty not exceeding forty shillings) be sent to the Medical Officer of Health *forthwith* on the Medical Practitioner attending on or called in to visit the patient becoming aware that the patient is suffering from an infectious disease to which the Act applies; namely, any of the following diseases: Small-pox, cholera, diphtheria, membranous croup, erysipelas, the disease known as scarlatina or scarlet fever, and the fevers known by any of the following names: typhus, typhoid, enteric, relapsing, continued or puerperal, and also any infectious disease to which the Act has been applied by the Local Authority in manner provided by the Act.

(*a*) Name in full of person suffering from disease.

(*b*) Number or name of the house, and name of the street or road and parish or place where person is resident. In the case of a ship, boat, tent, van, shed, or other similar structure, the name or description of the dwelling, and the name of the place where it is situate should be given.

(*c*) Name of disease.

The certificate is to be given in respect of a case of infectious disease to which the Act applies occurring in any building, not belonging to Her Majesty, used for human habitation, unless such building is a hospital in which persons suffering from an infectious disease are received (section 3 (1)); and also in a case occurring in any ship, vessel, or boat not belonging to Her Majesty or to a foreign Government, or in any tent, van, shed or similar structure used for human habitation and not belonging to Her Majesty, in like manner as nearly as may be as if it were a building (sections 13 and 15).

The penalty for default in sending the certificate is a fine not exceeding 40*s.* (section 3).

The forms of certificates are supplied gratuitously by the Local Authority, who also pay for every certificate sent by a medical practitioner in accordance with the requirements of the Act a fee of 2*s.* 6*d.* if the case occurs in the course of his private practice, or a fee of 1*s.* if the certificate is given in respect of a case occurring in his practice as Medical Officer of any public body or institution (section 4 (2)).

A certificate may be sent to the Medical Officer of Health by being delivered to the officer or being left at his office or residence, or may be sent by post addressed to him (section 8 (2)).

The infectious diseases to which the Act applies are the following diseases, namely:—smallpox, cholera, diphtheria, membranous croup, erysipelas, the disease known as scarlatina or scarlet fever, and the fevers known by any of the following names: typhus, typhoid, enteric, relapsing, continued, or puerperal, and also any infectious disease to which the Act has been applied by the Local Authority in manner provided by the Act (section 6).

The Local Authority may, by resolution, add any other infectious disease

either temporarily or permanently to the above list; but there is no power to rescind the adoption of the Act, so far as it applies to the above-named diseases.

The Infectious Disease (Prevention) Act, 1890.—This Act, like the Infectious Disease (Notification) Act, is unfortunately an "adoptive" Act, with the exception of London, in which it came into force in December, 1890. In other sanitary districts it only comes into force after being formally adopted by the local authority.

Increased control over milk supply is given in sec. 4, which enacts that if the Medical Officer of Health is in possession of evidence that any person in the district is suffering from infectious disease attributable to milk supplied from a dairy within or without the district, or that the consumption of milk from such dairy is likely to cause infectious disease to any person residing in the district, such officer shall, after receiving the authority of a justice for this purpose, have power to inspect the dairy in question, and if accompanied by a veterinary surgeon, to inspect the animals in it. If on such inspection the Medical Officer of Health is of opinion that infectious disease is caused from consumption of the milk supplied therefrom, he shall report thereon to the local authority, who shall give notice to the dairyman to appear before them, and to show cause why an order should not be made requiring him to discontinue supplying the milk. If in the opinion of the local authority he fails to show such cause, the order may be made, and shall hold good until they are satisfied that the cause of infection has been removed.

Sections 5 and 6 give increased powers of disinfection to the officers of the local authority. It is now generally admitted that domestic disinfection is of a most unsatisfactory character; by section 6, power is given to remove bedding, etc., for the purpose of disinfection by the local authority and at the cost of the latter.

It is forbidden to retain the body of any person who has died of any infectious disease elsewhere than in a public mortuary, or in a room not used as a dwelling-place, sleeping-place, or work-room, longer than forty-eight hours (sec. 8).

The bodies of persons dying of infectious diseases in hospitals are only allowed to be removed for the purpose of being forthwith buried (sec. 9).

By order of a justice of the peace, any person suffering from infectious disease, and then in a hospital for infectious disease, may, although unwilling, be detained there until free from infection, if it can be shown that he is without proper means of isolation and lodging elsewhere (sec. 12).

The throwing of infectious rubbish into ash-pits, etc., is forbidden (sec. 13).

The local authority is required to provide free temporary shelter with the necessary attendance to the members of any family who have been compelled to leave their houses to enable them to be disinfected by the local authority (sec. 15).

The Public Health Amendment Act, 1890.—This Act, like the last, is "adoptive," but does not apply to the metropolis. It contains

enactments forbidding the discharge of injurious matters into the sewers; as also of chemical refuse, waste steam, hot liquids, etc., if it can be shown that these cause a nuisance or are injurious to health (sec. 16, 17).

It also gives power to regulate sanitary conveniences for public accommodation (sec. 20), gives provisions for sanitary conveniences used in common by the occupiers of two or more dwelling-houses (sec. 21), and for manufactories or workshops (sec. 22).

It empowers urban authorities to make bye-laws with respect to the following matters, in addition to those enumerated in the Public Health Act: (*a*) for keeping water-closets supplied with sufficient water for flushing; (*b*) the structure of floors, hearths, and staircases, and the height of dwelling-rooms; (*c*) the paving of yards and open spaces about houses; (*d*) the provision in connection with new houses of secondary means of access for the removal of house-refuse, etc. (sec. 23).

Rooms over privies, middens, or ash-pits, are not allowed to be used as dwelling or sleeping rooms (sec. 24).

It is not lawful to erect a new building on any ground filled up with offensive matter, unless the latter is removed by excavation, or has become innocuous (sec. 25).

Urban authorities may make bye-laws (*a*) for prescribing the times for the removal through the streets of offensive or noxious matters or liquids; (*b*) for providing that the vessels or carts employed shall be properly constructed and covered (sec. 26).

The section of the Public Health Act relating to unsound meat (p. 30 is made to apply to articles which have been already sold (sec. 28).

The occupier of any registered slaughter-house who is convicted of having sold or had for sale unsound or diseased meat, may have his licence revoked by a court of summary jurisdiction (sec. 31).

Customs and Inland Revenue Act, 1890 and 1891.—Sec. 4 of the Act of 1890 provides that—

"The assessment to inhabited house duty of any house originally built or adapted by additions or alterations and used for the sole purpose of providing separate dwellings *for persons at rents not exceeding for each dwelling the rate of seven shillings and sixpence a week, and occupied wholly by persons paying such rents*, shall be discharged" by the Commissioners acting in the execution of the Acts relating to the inhabited house duties, if a certificate is produced to them to the effect that the house is so constructed as to afford suitable accommodation for each of the families or persons inhabiting it, and that due provision is made for their sanitary requirements. The certificate is to be obtained from the Medical Officer of Health for the district in which the house is situate, or from some other legally qualified medical practitioner having the qualification required for the office of Medical Officer of Health of the district, and appointed as provided by the section. The section makes it the duty of the Medical Officer of Health, on request by the person who would be liable to pay the house duty on any house in the district, if the duty were not discharged by the Commissioners, to examine the house for the purpose of ascertaining whether a certificate can properly be given; and if the house is constructed so as to afford suitable accommodation for each of the families or persons inhabiting it, and due provision is made for their sanitary requirements, the Medical Officer is to certify the same accordingly.

By section 4 of the Customs and Inland Revenue Act, 1891, this enactment is amended

by the substitution of the words "where the annual value of each dwelling shall not amount to £20," for the words "for persons at rents not exceeding for each dwelling the rate of seven shillings and sixpence a week, and occupied only by persons paying such rents."

Section 4 of the Act of 1891 further provides that in the case of any house originally built, or adapted by additions or alterations, and used, so far as the same is used as a dwelling-house, for the sole purpose of providing separate dwellings at an annual value not exceeding £40 for each dwelling, the Commissioners acting in the execution of the Acts relating to inhabited house duties shall, upon production of such a certificate as is mentioned in sub-section 2 of section 26 of the Act of 1890, grant relief by confining the assessment to the annual value of the house, exclusive of every dwelling therein of an annual value below £20 (if any), and by reducing the rate of duty to threepence.

The provisions in the sub-section referred to in relation to the certificate of the Medical Officer of Health or other medical practitioner, are made applicable to a certificate to be produced under Section 4 of the Act of 1891.

The Public Health (London) Act.—This Act, passed in 1891, consolidates and amends the laws relating to public health in the metropolis, thus doing away with the confusion arising from the numerous sanitary Acts previously in force, and assimilating the sanitary enactments of the metropolis to those of the rest of England and Wales, with some additions and amendations. The Infectious Disease (Notification) Act and the Infectious Disease (Prevention) Act are incorporated in the Public Health (London) Act.

Sec. 1 makes it the duty of the sanitary authority to cause inspection of the district to be made for the detection of nuisances, and along with sec. 40 gives the necessary power of entry to premises for the purpose of the Act.

Sec. 2 enumerates the nuisances which may be abated summarily, and includes in this list premises without a proper water supply, and workshops which are defective as to cleanliness, ventilation, and overcrowding.

Under the Public Health Act, 1875, the words are "a nuisance or injurious to health." In the Act of 1891 for London, "*or dangerous*" is added to these words, thus doing away with the necessity in any case of proving that ill effects have resulted.

By sec. 3 information as to a nuisance may be given not only by persons aggrieved thereby, but by any person, and it is also made the duty of every officer of the local authority and every relieving officer to give such information.

By sec. 5 on non-compliance with a notice for the abatement of any nuisance, the court of summary jurisdiction may, on complaint, make either (*a*) an abatement order, or (*b*) a prohibition order, prohibiting the recurrence of the nuisance, or (*c*) a closing order prohibiting a dwelling-house from being used for human habitation, where it is proved that by reason of a nuisance a house is unfit for human habitation.

Any person damaging or destroying any drain, water-closet, or water-supply apparatus, is liable to a fine of £5 (sec. 15).

It is compulsory on the sanitary authorities and County Council to make bye-laws for cleansing streets and prevention of nuisances from rubbish, offal, etc., and as to the paving of open spaces about houses; and

on the County Council to make bye-laws for the removal of filth, etc., in properly covered vessels, and as to the filling up of cesspools, etc.

The petty sessional court may prohibit the using of a place for the keeping of any animal, if it is proved to the satisfaction of the court that the place is unfit for this purpose (sec. 18).

By sec. 22 the removal of house refuse and street refuse is placed in the same category as offensive trades under private control, and the sanitary Authority are liable to be proceeded against for any infringement of the bye-laws made by the County Council in this behalf.

The control of smoke nuisances and of bakehouses is vested in the local authorities; the registration and regulation of dairies and cowsheds being placed under the control of the County Council (sec. 23–28).

It is made the duty of the sanitary authority not only to keep the streets swept and cleansed, but also to secure the regular periodical removal of house refuse. If after forty-eight hours' written notice, when the house refuse has not been removed from any premises at the proper period, the sanitary authority fail without reasonable cause to comply with this notice, they are liable to a fine not exceeding £20 (sec. 29, 30).

Sec. 48 constitutes a dwelling-house without a proper supply of water unfit for habitation; and by sec. 49 makes any water company liable to a penalty of £10 if within twenty-four hours after cutting off the water supply to any house for non-payment of water-rates they do not give notice to the sanitary authority. Every sanitary authority is required to make bye-laws for the cleansing of receptacles for storage of water for drinking or domestic purposes.

The clauses relating to the notification of infectious diseases (sec. 55–57) make it compulsory on Medical Officers of Health to send a copy of the certificate within twelve hours to the head teacher of the school attended by the patient (if a child), or by any child who is an inmate of the same house as the patient.

Sec. 58 to 81 re-enact the chief provisions of the Infectious Disease (Prevention) Act, 1890, with the addition that the provisions by the sanitary authority of disinfecting apparatus and carriages for conveying infected materials free of charge is made compulsory on them.

Every sanitary authority is required to provide and fit up a public mortuary; and it is made compulsory on the County Council to provide places for the holding of inquests (sec. 88–93).

Sec. 96–98 transfer the duty of discovering and dealing with underground rooms used as dwellings to the Sanitary Authorities, and makes the requirements in regard to them much more stringent.

The Medical Officer of Health appointed under this Act is required to reside in his district, or within a mile of its boundary. If the sanitary authority fail to appoint an adequate number of Sanitary Inspectors, the Local Government Board may, at the complaint of the County Council, direct the Sanitary Authority to appoint such additional Inspectors, and pay such remuneration as they may direct (sec. 106–109).

CHAPTER III.

SANITARY REGULATIONS.

Memoranda and Regulations on Sanitary Matters.—Regulations as to Hospitals.—Ambulances.—Rules for Hospitals for Infectious Diseases.—Memorandum on the proceedings advisable in places attacked or threatened by Epidemic Disease.—Suggestions of the Society of Medical Officers of Health as to precautions against the Spread of Infectious Diseases.—Bye-laws on the Cleansing of Footways, Removal of House Refuse, and Cleansing of Earth-closets, Privies, Ashpits, and Cesspools.—Bye-laws on the Prevention of Nuisances from Snow, Filth, Dust, etc., and the Keeping of Animals.—Bye-laws as to New Streets and Buildings; *Streets; Walls, Foundations and Chimneys; Open space about Buildings and Ventilation; Drainage of Buildings; Water-closet; Earth-closets; Privies; Ashpits; Cesspools; Houses Unfit for Human Habitation; Control of the Erection of New Houses.*—Bye-laws as to Common Lodging-Houses; Seamen's Lodging-Houses.—Slaughter-Houses.

Memoranda and Regulations on Sanitary Matters.—Local authorities have, as we have already seen, the power to make bye-laws on various sanitary matters, which must be first submitted to the Local Government Board. In order to secure that these shall possess a certain amount of uniformity, and to help local authorities, the Local Government Board have drawn up a set of *model bye-laws* prepared by distinguished specialists, and have also issued various *memoranda* on various points of legislation and administration. The regulations as to new buildings and the paving of streets, for instance, were prepared by the Royal Institute of British Architects. In the following pages will be found a summary of these model bye-laws and memoranda.

Regulations as to Hospitals (*Memorandum on Hospital Accommodation. Report of the Royal Commission on Cubic Space in Workhouses*).—Means for separating the sick from the healthy should always be provided. When two contagious diseases break out at the same time, they should each be separately isolated.

In towns, and for several villages of smaller size, there should be provided at least two special wards with four beds in each, in order that the sick may be isolated from the commencement. Such a very small infirmary would be very valuable for arresting the progress of an epidemic.

Fig. 1 represents a very simple type of hospital, having one ward for each sex, with the necessary annexa. This plan accompanies the memorandum of the Local Government Board.

Fig. 2 represents two sections of the same building, the one to the left having simple walls and serving for summer rooms; the one to the right

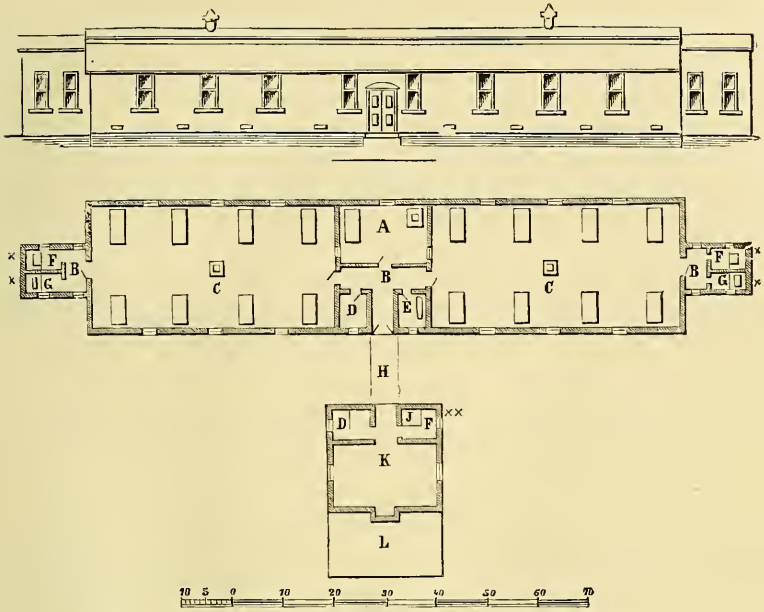

FIG. 1.—ELEVATION AND PLAN OF A SMALL HOSPITAL.

(*Scale shown in English feet.*)

A. Small separate apartment. **B.** Passage connecting the two wards. **C.** Stove. **D.** Store-room. **E.** Bath-room. **F.** Water-closets. **G.** Lavatories. **H.** Covered way. **J.** Coal-house. **K.** Kitchen. **L.** Space for additional buildings if required.

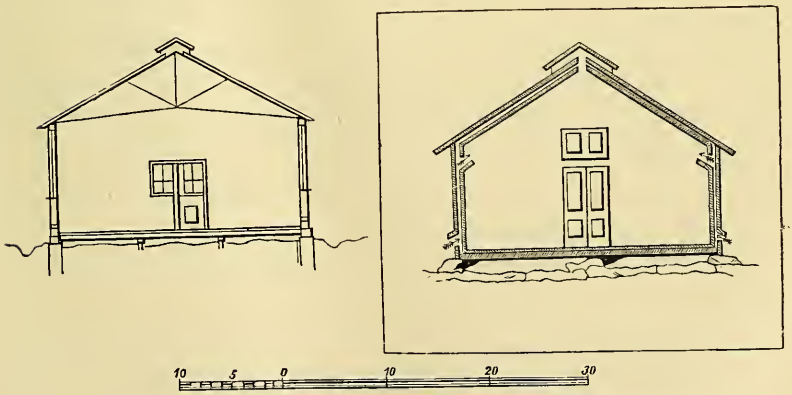

FIG. 2.—VERTICAL SECTIONS THROUGH THE SAME HOSPITAL.

(*Scale in English feet.*)

having double walls is a permanent structure. At the base of the external walls are openings for the admission of fresh air, seen on the front of the elevation (Fig. 1). In the roof are other openings for the escape of foul air, but chimneys or special tubes are the best for this purpose.

In rural districts without a hospital, a trustworthy married couple without children may be charged with the isolation and care of cases of infectious disease. In the event of a more serious epidemic, several lodgings may be hired for the sick, or they may be isolated in temporarily erected tents or barracks.

Fever hospitals in urban districts ought to have one bed for every 1,000 inhabitants. In manufacturing towns with a very dense population, this proportion ought to be even greater; while in wealthy and less dense towns,

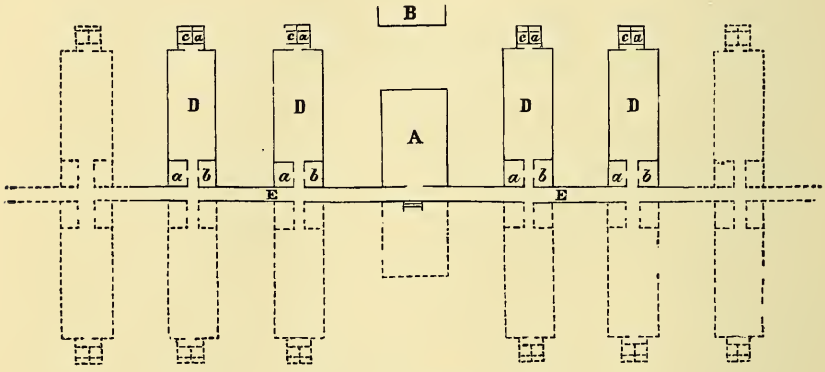

FIG. 3.—PERMANENT HOSPITAL IN PAVILIONS.

with houses of a good class, one bed for every 2,000 inhabitants may suffice.

Permanent fever hospitals are built on the system of separate pavilions. There must be at least four wards for patients, as well as a pavilion for administration.

Sick wards can be arranged in pavilions connected in pairs, as shown in Fig. 3, which is taken from the memorandum of the Local Government Board. The dotted lines in this figure show how, as the population increases, the permanent hospital can be enlarged.

The minimum distance between the pavilions should be 30 feet.

Fig. 4 shows another arrangement of sick wards, which is preferable when sufficient ground is available.

The sick wards may also be placed on different storeys of the same pavilion.

Two of them, one for each sex, are reserved for persons suffering from the same infectious disease.

All the wards should be kept separate, and independently warmed and ventilated. To facilitate the work of the staff, a corridor connects all the pavilions. The latter should be so placed that the air can circulate freely

between them. The space between the pavilions should be at least one and a half times as great as the height of each pavilion; and if a pavilion is

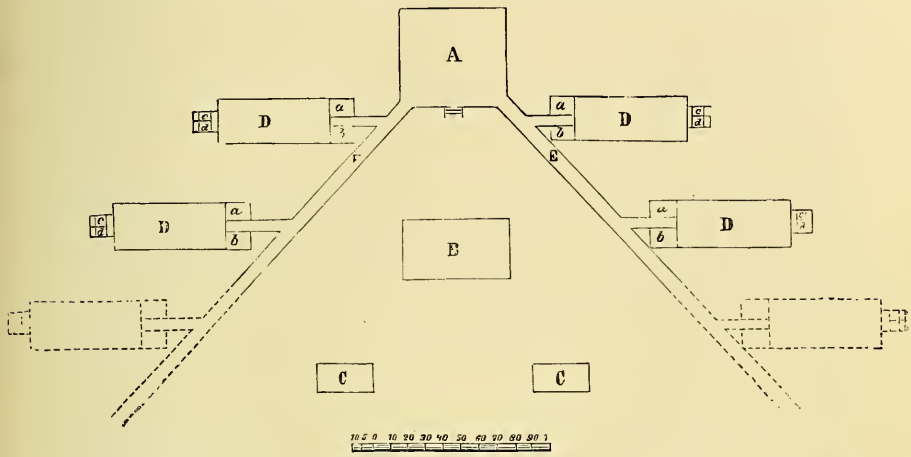

FIG. 4.—ANOTHER ARRANGEMENT OF A PERMANENT HOSPITAL IN PAVILIONS.
(*Scale in Feet.*)

A. Administrative building (kitchen, store, sleeping accommodation for nurses and servants). **B.** Laundry, etc. **C, C.** Disinfecting chamber and mortuary. **E.** Corridor. **D.** Wards for patients with ten beds in each, lavatory and bath-room (*a*, *b*) next the corridor; closets and sinks (*c*, *d*) at the other end, and separated from the ward by a cross-ventilated corridor.

intended for small-pox, the distance should be still greater. It is preferable to place small-pox in an entirely separate building, as remote as possible from all other buildings.

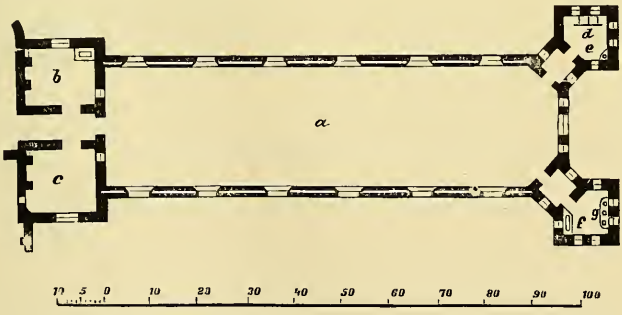

FIG. 5.—HOSPITAL WARD ACCORDING TO GALTON'S DESIGN.

Fig. 5 represents a sick ward designed by Douglas Galton. On each side of the entrance are two small rooms, of which one, *c*, is for the nurse, with a small window for observation into the ward. The other, *b*, serves for various requirements of the household, as for making tea and refreshing drinks, and for storing linen, etc. At the other end of the ward jutting

out at each corner are water closets *d*, sink *e*, bath-room *f*, and lavatory *g*. These are separated from the sick ward by a lobby with free cross-ventilation by means of windows.

The wards of the principal hospitals in Great Britain are constructed according to this model, as those of St. Thomas's Hospital, the Herbert Hospital, and the Royal Infirmary, at Edinburgh.

In large hospitals, the relative positions of the pavilions can be variously modified.

The double pavilions (Fig. 3) with a central corridor form an arrangement which takes up the least space. The size and form of wards will be determined by the number of patients, the superficial and cubic space allowed for each patient, the system of heating, lighting, and ventilation, and the organization of the hospital.

In small hospitals, it is preferable to have small wards. In large hospitals some smaller wards should be provided for the isolation of special cases.

Before determining the number of sick to be placed in a single ward, one must know how many patients each nurse can conveniently take care of. According to Miss Nightingale, whose authority is well recognised, this number should be 32. "A nurse," she says, "can satisfactorily take charge of 32 patients in a single ward, and a night nurse can perfectly well take charge of the same number, which would be impossible if they were in four separate rooms" (*Report on Metropolitan Workhouses*).

The laundries and mortuaries of a hospital should be situated in separate buildings.

The part occupied by the administration should only communicate with the sick pavilions by covered corridors, furnished with windows on opposite sides to ensure free circulation of air, and the entrance to it should be so placed that the sick wards are not approached in reaching it.

Hospitals should be placed as far as possible from private houses; they should be fully exposed to all winds; and should have a floor space of over 100 square feet for each patient.

Fever hospitals should have a floor space of at least 144 square feet, and a cubic space of at least 2000 cubic feet per patient.

The wards should be 13 feet high; but if the height exceeds this amount, it should not be taken into consideration in reckoning the cubic space for each patient. The boundary wall should be at least 40 feet distant from any place used for the reception of infected persons or things.

For persons affected with chronic diseases, and lodged temporarily in a hospital or in a workhouse, 800 cubic feet of space have been considered sufficient for each patient, with a floor space of 65 square feet, 54 for each bed. With such an allowance the ventilation should be very good, and beds should only be placed along each wall of the room. If during the day the patients live in a separate room, the dimensions can be reduced to 500 cubic feet, and to 40 square feet per bed.

The flooring should be composed of boards well jointed. It should be

ventilated beneath, and the joists should rest on a bed of asphalte or concrete. The walls should be covered internally with Parian cement, and either painted or lime-washed ; the ceilings should have no projections or cornices.

The windows ought to be placed opposite each other on the longitudinal walls of the pavilion, so as to ensure cross-ventilation. The best means to ensure this is to have a window on either side of each bed. The lower end of the windows should be 3 feet from the floor, and the upper end 6 inches from the ceiling. The window space should be one-third of the wall-space (Nightingale).

The best ventilation is obtained by panes opening within the ward, by means of hinges placed at the lower end of the panes. Vitiated air escapes by the fire-place, or at a higher point into the chimney-breast. In addition to windows, inlet ventilation should be provided by openings in the walls (as by Sheringham's valves or Tobin's tubes).

In wards for infectious diseases there should be openings for admission of fresh air between each bed, a little above the floor, so that pure air bathes the patient's bed. They should be furnished with a grooved fastening, so that the admission of air can be graduated. The openings for extraction of foul air should be near the ceiling, and as remote as possible from those admitting fresh air. They should, unless entering into the chimney-breast, be carried vertically to the roof and be provided with an aspirating cowl.

The ventilation should be so arranged as to provide for the entry of 2,500 cubic feet of fresh air for each patient per hour.

The ventilating openings should be so arranged that they can easily be cleansed and freed from dust ; and they should be so placed that the air introduced is the purest possible. The outer surface should be furnished with a grating to prevent the entrance of birds, etc.

The warming of hospital wards is effected by means of open fireplaces, or by hot water pipes, or by the two systems combined. The fireplaces are frequently constructed on the principle of Galton's stove, fresh air entering by a tube, of which one extremity communicates with the external air, and the other opens into a space surrounding the chimney-flue. From the latter the heated air enters the room by an opening above or at the side of the fireplace.

The following is the distinguished inventor's description of Galton's stove :—

The body of the stove is of the best cast-iron, and consists of three pieces, properly connected by screws. The first piece forms the moulded projecting frame ; the second the body of the grate ; and the third the nozzle or connexion with the smoke-flue, the bottom flange of which is bolted to the back of the grate. The stoves are of three sizes. The largest has an opening for fire of 1 ft. 9 ins. wide, and was intended for rooms containing from 7,500 to 10,000 cubic feet ; it weighs about 3 cwt. 1 qr. 10 lbs. The second or medium size, has an opening for fire, 1 ft. 5 ins. wide, and was intended for rooms containing from 3,600 to 7,500 cubic feet ; it weighs about 2 cwt. 3 qrs. 5 lbs. The third or smallest size, has an opening for fire 1 ft. 3 ins. wide, and was intended for rooms containing 3,600 cubic feet and under ; it weighs about 2 cwt. 2 qrs.

Fig. 6 shows an elevation, section, and plan of the medium size stove, the extreme dimensions of which are 40 inches wide by 42 inches high. The projecting moulded frame enables the stove to be applied to any existing chimney opening.

The fireplace has a lining of fire-lumps in five pieces—two sides, one back piece, and two bottom pieces, moulded to the form shown in the wood-cut. The object of this fire-clay lining or cradle is to prevent the contact of the incandescent fuel with the iron, and to preserve a high uniform temperature in the vicinity of the fuel to assist the combustion.

The bottom is partly solid, being made of two fire-lumps placed one on each side, and supporting an intermediate cast-iron fire-grating, which occupies about one-third of the

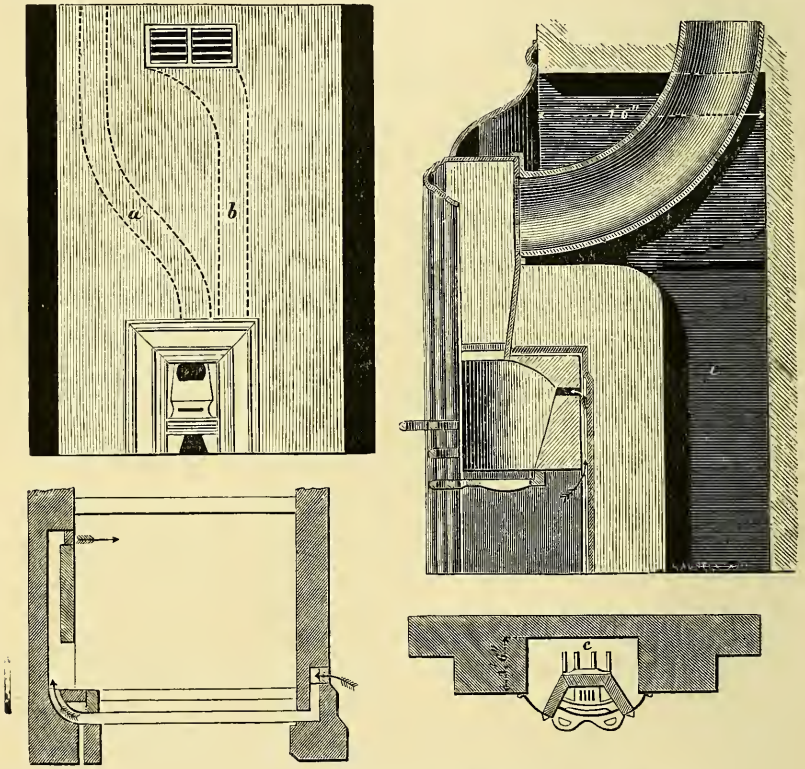

FIG. 6.—DOUGLAS GALTON'S VENTILATING STOVE.
a. Smoke flue. *b*. Air flue. *c*. Air chamber.

bottom of the grate; by this means, while the draught is checked by the solid part of the bottom of the grate, and the consumption of fuel reduced, a sufficient supply of air is obtained for combustion through the grating to secure a cheerful fire. A clear space, half an inch deep, is formed between the back piece of fire-lump, and the iron back of the grate, through which a supply of air passes from the ash-pit under the grate, and through a slit in the fire-lump, on to the upper part of the back of the fire. The air thus brought into contact with the heated coal is received at a high temperature, in consequence of passing through the heated fire-lump, and is forced into contact with the gases from the coal by means of the piece of fire-lump which projects over the fire at the back of the grate; and thus a more perfect combustion of the fuel is effected than with an ordinary grate, and the creation of smoke is prevented; in fact, with care, almost perfect combustion of the fuel, and subsequent utilisation of the heat, can be obtained.

While the incandescent fuel and flame are kept away from actual contact with the iron back of the stove, the heated gases from combustion, and such small amount of smoke as exists, are compelled, by the form of the back of the stove, and the iron part of the smoke-flue, to impinge upon a large heating surface, so that as much heat as possible may be extracted from the gases before they pass into the chimney; the heat thus extracted is employed to warm air taken directly from the outer air. The air is warmed by the iron back of the stove and smoke-flue, upon both of which several broad flanges are cast, so as to obtain a large surface of metal to give off the heat. This giving-off surface (amounting in the case of No. 1 grate to about 18 square feet) is sufficient to prevent the fire from ever rendering the back of the grate so hot as to injure the air which it is employed to heat. The fresh air, after it has been warmed, is passed into the room near the ceiling by the flue shown in the woodcut.

In order to afford facilities for the occasional cleansing of the air-chamber, and those parts of the air-channels connected with it, the front of the stove is secured by screws, so that it can be easily removed, thus rendering the air-chambers accessible.

In applying the stove to existing chimney openings, the air-chamber (*c*) is to be left as large as possible, thoroughly cleansed, rendered with cement, and lime-whited.

Great care must be taken in bedding the several joints to prevent smoke from the flue passing into the fresh air chamber or flue (*c*).

If the fireplace is built in an external wall, the opening for fresh air can be made in the back; but if in an internal wall, it will be necessary to construct a channel from the outside. Such horizontal ducts should contain a sectional area of 84, 60, or 36 square inches, according to the size of the grate; the clear area through the grating covering the opening to the outer air should be equal in area with that of the flue. If the flues are of considerable length, and with bends, the sectional area should be rather more than that mentioned, to allow for friction; or rather less than the amount recommended if there is a direct communication with the outer air.

The amount of air delivered through the fresh air flue varies somewhat with the direction of the wind. The inlet shaft acts best when the windows, doors, and other inlets to the room are closed.

The fresh air should be taken from places where impurities cannot affect it, and the flue must be so arranged and constructed as to afford easy means of being periodically thoroughly examined and cleansed.

In the hot water system, each coil of pipes should be connected with an opening for pure air, so that warmed air is drawn into the ward.

The furniture of a hospital should be confined to necessary articles, and should not be large and heavy. Iron beds should be used, with horse-hair mattresses resting on a chain or wire mattress.

The bed coverings should be light coloured and often exposed to the air.

Where, owing to the absence of the necessary water-supply and drains, water-closets cannot be adapted, earth-closets are in use.

Every hospital should possess a disinfecting apparatus.

Memorandum on Ambulances.—For the conveyance of patients who are sick with infectious disease, special carriages, which are known by the name of "ambulances," are necessary. The following points have to be attended to in the provision and use of such carriages:—

1. If the ambulance be intended only for journeys of not more than a mile, it may be made so as to be carried between two people, or it may be on wheels and to be drawn by hand. If the distance be above a mile, the ambulance should be drawn by a horse. Every ambulance on wheels should have easy carriage-springs.

2. In the construction of an ambulance, special regard should be had to the fact that after each use, it has to be cleansed and disinfected. The entire interior, and the bed-frame and bed, should be of materials that can be washed.

3. The ambulance should be such that the patient can lie full length in it; and the bed-frame and bed should be movable, so that the patient can be arranged upon the bed before being taken out of his house.

4. With an ambulance there should always be a person specially in charge of the patient; and a horse ambulance should have a seat for such person inside the carriage.

5. After every use of an ambulance for infectious disease, it should be cleansed and disinfected to the satisfaction of a Medical Officer.

6. Both in very populous districts, and in districts which are of very wide area, it may often happen that more than one ambulance will be wanted at one time; and, in any district, if more than one infectious disease is prevailing, there will be an evident sanitary advantage in having more than one ambulance for use.

Rules for Hospitals for Infectious Diseases.—1. The Medical Officer is the responsible superintendent of the establishment. It is his duty to visit the hospital even at times when there are no patients, to ensure that the matron and nurse are at their post, and that everything is ready for the reception of patients.

2. The matron and head-nurse ought to maintain the greatest cleanliness and to see that the beds are well aired, conveniently arranged, and always ready to receive patients. They ought also to keep the inventory of everything belonging to the hospital. They are forbidden to absent themselves together without express authority. They must carry out the orders of the doctor and be responsible for the conduct of the staff and the nurses.

3. The matron (or steward, if there is one, as in large hospitals) must be prepared monthly to present the books of accounts to the sanitary authority.

Instructions for Nurses, Patients, and Visitors.—1. Every applicant for admission to a hospital should have a medical certificate of the disease from which he is suffering.

2. A patient can be attended by a doctor of his own choice other than the Medical Officer of the hospital at his own cost.

3. No person is admitted to the hospital without the permission of the Medical Officer.

4. No patient is permitted to leave the hospital, until discharged by the Medical Officer (see also p. 54).

5. The patient's clothes must be disinfected before being given up to him at his discharge.

6. Officers and servants of the hospital are not allowed to leave the hospital without authority of the Medical Officer; and they must first change their clothes.

General Memorandum on the Proceedings which are advisable in Places attacked or threatened by Epidemic Disease.—The following circular has been issued by the Medical Officer to the Local Government Board.

1. Wherever there is prevalence or threatening of cholera, diphtheria, fever, or any other epidemic disease, it is of more than common importance that the statutory powers conferred upon sanitary authorities for the protection of the public health should be well exercised by those authorities acting with the advice of their Medical Officers of Health.

2. Proper precautions are equally requisite for all classes of society. But it is chiefly with regard to the poorer population, therefore chiefly in the courts and alleys of towns, and at the labourers' cottages of country districts, that local authorities are called upon to exercise vigilance, and to proffer information and advice. Common lodging-houses, and houses which are sub-let in several small holdings, always require particular attention.

3. Wherever there is accumulation, stink, or soakage of house refuse, or of other decaying animal or vegetable matter, the nuisance should as promptly as possible be abated, and precaution should be taken not to let it recur. Especially examination should be made as to the efficient working of sewers and drains, and any defect therein, and any nuisance therefrom or from any foul ditches or ponds should be got rid of without delay. The ventilation of sewers, the ventilation and trapping of house drains, and the disconnection of cistern overflows and sink pipes from drains should be carefully seen to. The scavenging of the district, and the state of receptacles for excrement and of dust-bins, will require close attention. In slaughter-houses, and wherever animals are kept, strict cleanliness should be enforced.

4. In the removal of filth during periods of epidemic disease, it is commonly necessary to employ chemical agents for reducing or removing the offence and harm which may be involved in the disturbance of the filth. In the removal of privy contents these agents are more particularly wanted if the disease in question be cholera or enteric fever. The chemical agent should be used liberally over all exposed surfaces from which filth has been removed. Unpaved earth close to dwellings, if it be sodden with slops or filth, ought to be treated in the same way.

5. Sources of water supply should be well examined. Water from sources which can be in any way tainted by animal or vegetable refuse, especially those into which there may be any leakage or filtration from sewers, drains, cesspools, or foul ditches, ought no longer to be drunk. Above all, where the disease is cholera, diarrhœa, or enteric fever, it is essential that no impure water be drunk.

The liability of leaky water-pipes to act as land drains and to receive foul matters as well as land drainage through their leaks is not to be overlooked. And such leaky pipes, running full of water with considerable velocity, are liable to receive, by lateral insuction at their points of leakage, external matters that may be dangerous. This latter fact is not recognised so generally as it should be; and ignorance of it has probably baffled many inquiries in cases where water services have in truth been the means of spreading disease.

If, unfortunately, the only water which for a time can be got should be open to suspicion of dangerous organic impurity, it ought at least to be boiled before it is used for drinking, but then not to be drunk later than 24 hours after it has been boiled. Filtering of the ordinary kind cannot by itself be trusted to purify water. It cannot be too distinctly understood that dangerous qualities of water are not obviated by the addition of wine or spirits.

6. When there appears any probable relation between the distribution of disease and of milk supplies, the cleanliness of dairies, the purity of the water used in them, the health of the persons employed about them, and the health of the cows that furnish milk should always be carefully investigated. Even apart from any apprehension of milk being concerned in a particular outbreak of disease, it is desirable that English people should adopt the custom, which is always followed in some continental countries, of boiling all milk at once upon its reception into a house.

7. The washing and lime-whiting of uncleanly premises, especially of such as are densely occupied, should be pressed with all practicable despatch.

8. Overcrowding should be prevented. Especially where disease has begun, the sick-room should, as far as possible, be free from persons who are not of use to the patient.

Ample ventilation should be enforced. It should be seen that windows are made to open, and that they are sufficiently opened. Especially where any kind of infective fever has begun, it is essential, both for patients and for persons who are about them, that the sick-room and the sick-house be constantly traversed by streams of fresh air.

9. The cleanliest domestic habits should be enjoined. Refuse matters should be speedily removed or destroyed; and things which have to be disinfected or cleansed should always be disinfected or cleansed without delay.

10. Special precautions of cleanliness and disinfection are necessary with regard to infective matters discharged from the bodies of the sick. Among discharges which it is proper to treat as infective are those which come in cases of small-pox and scarlatina from the affected skin; in cases of cholera and enteric fever from the intestinal canal; in cases of diphtheria and scarlatina from the nose and throat; likewise, in cases of any eruptive or other epidemic fever, the general exhalations of the sick. The caution which is necessary with regard to such matters must, of course, extend to whatever is imbued with them; so that bedding, clothing, towels, handkerchiefs, and other articles which have been in use by the sick may not become sources of mischief, either in the house to which they belong or in houses to which they are conveyed. So far as articles of this class can be replaced by rags or things of small value, it is best to use such things and burn them when they are soiled. Otherwise clothing and infected articles should be subjected to the disinfectant of the sick room or be removed for disinfection by heat.

In enteric fever and cholera the evacuations should be regarded as capable of communicating an infectious quality to any nightsoil with which they are mingled in privies, drains, or cesspools; and after such disinfection of them as is practicable, they should be disposed of without delay and under the safest conditions that local circumstances permit. They should not be thrown into any fixed privy receptacle, and above all, they must never be cast where they can run or soak into sources of drinking water.

11. All reasonable care should be taken not to allow infective disease to spread by the unnecessary association of sick with healthy persons. This care is requisite, not only with regard to the sick-house, but likewise with regard to schools and other establishments wherein members of many different households are accustomed to meet.

12. If disease begins in houses where the sick person cannot be properly accommodated and tended, medical advice should be taken as to the propriety of removing him to an infirmary or hospital. Every sanitary authority should have in readiness a hospital for the reception of such cases.

Where dangerous conditions of residence cannot be promptly remedied, it will be best that the inmates, while unattacked by disease, remove to some safer lodging.

13. Privation, as predisposing to disease, may require special measures of relief.

14. In certain cases special medical arrangements are necessary. For instance, as cases of cholera in this country often begin somewhat gradually in the comparatively tractable form of what is called "premonitory diarrhœa," it is essential that, where cholera has appeared, arrangements should be made for affording medical relief without delay to persons attacked, even slightly, with looseness of bowels. So, again, where small-pox is the prevailing disease, it is essential that all unvaccinated persons (unless they previously have had small-pox) should very promptly be vaccinated; and that re-vaccination should be performed in cases properly requiring it.

15. It is always to be desired that the people should, as far as possible, know what real precautions they can take against the disease which threatens them, what vigilance is needful with regard to its early symptoms, and what (if any) special arrangements have been made for giving medical assistance within the district. For the purpose of such information, printed hand-bills or placards may usefully be employed, and in cases where danger is great, house-to-house visitation by discreet and competent persons may

be of the utmost service, both in quieting unreasonable alarm and in leading or assisting the less educated and the destitute parts of the population to do what is needful for safety.

16. The present memorandum relates to occasions of emergency. Therefore the measures suggested in it are essentially of an extemporaneous kind; and permanent provisions for securing the public health have, in express terms, been but little insisted on. It is to be remembered, however, that in proportion as a district is habitually well cared for by its sanitary authority, the more formidable emergencies of epidemic disease are not likely to arise in it.

17. Provision by the public authority for disinfection by heat of bulky articles, and of those which cannot without injury be exposed to chemical agencies, ought always to be in readiness. Without such provision no complete disinfection can be effected. Partial and nominal disinfection, besides being wasteful, may be mischievous, as giving rise to a false security.

18. The following system of domestic disinfection may be commended to sanitary authorities who have already provided adequate public means for the disinfection and for the disposal of infected matters and things:—

(*a*) For the purposes of the sick room, such as the reception of soiled handkerchiefs, sheets, and the like, as well as for the swabbing of floors, a valuable disinfecting solution may be made with perchloride of mercury. It is well to have this solution slightly acid, coloured also in such a way that it shall not readily be confused with drinks or medicines; and proper caution should be given to avoid accidents in its use. Sanitary Authorities will find it advantageous to have such a solution [1] prepared under the direct instructions of the Medical Officer of Health, and supplied of a uniform strength at the infected house upon the order of that officer.

(*b*) In places provided with proper systems of excrement disposal, excrements of cholera and enteric fever, after being treated in detail with the same disinfecting solution in ample quantity, may be safely put into the ordinary closet; but special care as to the flushing of drains and sewers, and special frequency in the removal and exchange of excrement receptacles, will commonly be wanted. Where the only closet is one that communicates with a cesspool or privy pit, the best arrangement for the disposal of infected stools that under these improper local circumstances may be found practicable will have to be adopted.

(*c*) A substance generally available in the removal of filth from privies and ash-pits, and for application to foul earth and the like,[2] is sulphate of iron (green copperas), either in a strong solution made by stirring crystals of the salt with five or ten times their bulk of hot water, or in the form of powder, to which form the crystals may be readily brought after dessication. This agent should be used in quantity sufficient to destry all odour, and in the removal of filth accumulations it should be well mixed with successive layers of the matter to be removed. The dry form of application is to be preferred where masses of wet or semi-solid filth have to be dealt with.

(*d*) For disinfection of the air of rooms, after the room has been prepared by the re-

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[1] A solution fitted for the desired purposes may be made with ½ oz. corrosive sublimate, 1 fluid oz. hydrochloric acid, and five grains of commercial aniline blue, in three gallons (a bucketful) of common water. It ought not to cost more than 3*d*. the bucketful, and should not be further diluted. The use of non-metallic vessels (wooden or earthenware house tubs or buckets) should be enjoined on those who receive it, and articles that have been soaked in it should be set to soak in common water for some hours before they go to the wash.

[2] The removal of dangerous filth is here the object to be attained. It cannot confidently be stated that either the iron salt or any available substance will effect a true disinfection of such masses of filth as are here in question.

moval of persons and of such articles as are best disinfected by heat, and by the closure of windows and crevices, sulphurous acid gas in ample quantity may be evolved, the doors being kept closed for six hours or more. The amount of sulphurous acid required for the disinfection of a moderate sized room can be obtained by burning 1½ lbs. of sulphur (roll brimstone) in a pipkin over a small fire placed in the middle of a room, with an old tray or the like to protect the flooring. These processes should be effected by skilled persons acting under the directions of the Medical Officer of Health.

(*e*) After measures of disinfecting a room have been taken, all wall paper should be stripped from the walls and be burned, and the room ought to have its ceilings and walls thoroughly washed or lime-whited.

Suggestions of the Society of Medical Officers of Health as to Precautions against the spread of Infectious Diseases.—Although these suggestions are not official memoranda, they are worthy of reproduction as summarising the means specially recommended by a society representing the whole of the Medical Officers of Health of England and Wales for the prevention of the spread of infectious disease. It should be borne in mind that these recommendations were drawn up several years ago, and in some respects therefore require remodelling and bringing up to date.

Separation of the Sick.—Separate the sick person from the rest of the family directly illness appears, placing him, if possible, in a room at the top of the house, and taking care to remove carpets, curtains, and all unnecessary articles of furniture and clothing therefrom.

Ventilation of Sick Room and House.—Admit fresh air by opening the upper sash of the window. The fire-place should be kept open, and a fire lighted if the weather permits. Fresh air should be freely admitted through the whole house by means of open windows and doors. The more air that passes through the house the less likely is the disease to spread.

Disinfection of Sick Room.—Hang up a sheet outside the door of the sick room, and keep it wet with a mixture made either with a quarter of a pint of carbolic acid (No. 4) or a pound of chloride of lime, and a gallon of water. The floor should frequently be well sprinkled with either of the same disinfectants, and cloths, wetted with either, hung up in the room.

Disinfection of Matters Passed from the Sick.—Everything that passes from the sick person should be received into vessels containing half a pint of a solution of green copperas, made by dissolving one pound of the copperas in a gallon of water. A like quantity of the solution of copperas should be added to the discharges before emptying them into the closet.

Disinfection of Sinks, etc.—Care of Well and Drinking Water.—Every sink, closet, or privy, should have a quantity of one of the above-named disinfectants poured into it daily, and the greatest care should be taken to prevent the contamination of well or drinking water by any discharges from the sick person.

Disinfection of Utensils.—All cups, glasses, spoons, etc., used by the sick person, should be first washed in the above-named solution of carbolic acid, and afterwards in hot water, before being used by any other person.

No article of food should be allowed to remain in the sick room. No food or drink that the sick person has tasted, or that has been in the sick room should be given to anyone else.

Disinfection of Linen, etc.—All bed and body linen, as soon as removed from the sick person, and before being taken from the room, should be first put into a solution of carbolic acid of the above-mentioned strength, remaining therein for at least an hour, and afterwards boiled in water. Instead of handkerchiefs, small pieces of rag should be used, and these, when soiled, should be immediately burnt.

Nurses.—Personal Cleanliness.—Persons attending on the sick should not wear woollen garments, as they are likely to retain infectious poison: dresses of cotton or of some washable material should be worn. Nurses should always wash their hands immediately after attending to the sick person, using carbolic acid soap instead of ordinary soap.

Precautions with regard to Visitors.—It is of the utmost importance that the sick room be not frequented by others than those in immediate attendance on the sick, as the clothing of visitors is very liable to carry away infection.

Precautions during Recovery.—The scales and dusty powder which peel from the skin in scarlet fever, and the crust in small-pox, being highly infectious, their escape may be prevented by smearing the body of the sick person all over every day with camphorated oil. This, and the after use of warm baths, and carbolic acid soap are most essential. The sick person must not be allowed to mix with the rest of the family until the peeling has entirely ceased and the skin is perfectly smooth; clothes used during the time of illness, or in any way exposed to infection, must not be worn again until they have been properly disinfected.

Final Disinfection of Sick Room, Bedding, etc.—When the sickness has terminated, the sick room and its contents should be disinfected and cleansed. This should be done in the following manner:—Spread out and hang upon lines all articles of clothing and bedding; well close the fireplace, windows, and all openings; then take a quarter to a half a pound of brimstone, broken into small pieces; put them into an iron dish, supported over a pail of water, and set fire to the brimstone by putting some live coals upon it. Close the door, and stop all crevices, and allow the room to remain shut up for twenty-four hours. The room should then be freely ventilated by opening the door and windows; the ceiling should be white-washed, the paper stripped from the walls and burnt, and the furniture, and all wood and painted work be well washed with soap and water containing a little chloride of lime. Beds, mattresses, and articles which cannot well be washed, should, if possible, be submitted to the action of heat in a disinfecting chamber, usually provided by the local authorities. Until this process of disinfection is effectually carried out, the room cannot be safely occupied.

Attendance of Children at School.—Children should not be allowed to attend school from a house in which there is infectious disease, as, although

not ill themselves, they are very likely to carry the infection, and so spread the disease. No child should be allowed to re-enter a school without a certificate from the medical attendant, stating that he can do so without any danger of infecting children.

Precautions in case of Death.—In case of death the body should not be removed from the room, except for burial, unless taken to a mortuary, nor should any article be taken from it until disinfected as already directed. The body should be put into a coffin as soon as possible, with a pound or two of carbolic powder. The coffin should be fastened down and the body buried without any delay.

Model Bye-Laws with respect to the Cleansing of Footways and Pavements, the Removal of House Refuse, and the Cleansing of Earth-Closets, Privies, Ash-pits, and Cesspools.—When these duties are not undertaken by the local authority (page 58), the model bye-laws of the Local Government Board contain regulations, of which the following is a summary, which may be adopted with or without modification by the Local Authority :—

1. The occupier of any premises abutting on any street shall at least once a day, except on Sundays, cleanse the footways and pavements adjoining his premises.

In less populous parts longer intervals may be fixed on in the bye-law.

2. The occupier of any premises shall at least once a week remove the house refuse from his premises.

3. He shall at least once in three months cleanse every earth-closet on his premises which is provided with a fixed receptacle for fæcal matter, and with suitable arrangements for the application of dry earth thereto.

This interval is found to suffice for sanitary purposes, as under the proper use of dry earth the stools and even the paper become disintegrated and disappear without fætor in the compost.

4. The occupier of any premises shall at least once in every week cleanse every earth-closet which is furnished with a movable receptacle for fæcal matter, and with proper arrangements for applying dry earth.

The weekly emptying of such pails is found necessary, in order that the pails may be of a size which is manageable during scavenging.

5 and 6. The occupier of any premises shall, once at least in every week, cleanse every privy belonging to them which is furnished with a fixed or a movable receptacle for fæcal matter.

7 and 8. The occupier of any premises shall, once at least in every week, cleanse every ash-pit belonging to it, whether this is used only as a receptacle for ashes, dust, and dry refuse, or for these with fæcal matter.

9. The occupier of any premises shall once at least in every three months cleanse every cesspool.

Summary of Model Bye-laws as to the Prevention of Nuisances arising from Snow, Filth, Dust, Ashes, and Rubbish, and the Prevention of the Keeping of Animals on any Premises so as to be injurious to Health.

1 and 2. The footways of pavements must be cleared of accumulations of snow by the occupier of the abutting premises; and in such a manner as to prevent any undue accumulation in any neighbouring channel or carriage way.

3. If salt is mixed with the snow to facilitate its removal, the mixture must be effectually removed from the pavement.

A very low temperature is produced by the mixture, and it is very difficult thoroughly to dry leather wetted with it.

4. The filth, ashes, etc., when removed from any premises, must not be deposited upon any footway or carriage way; and must be removed in a covered receptacle, so as to prevent any spilling. Any refuse accidentally spilt during removal must be immediately swept up.

4*a*. Privies, cesspools, or other receptacles for filth belonging to any premises situated within twenty yards from any street or house must not be emptied or cleansed except between 6 a.m. and 8.30 a.m. in the summer months, and between 7 and 9.30 a.m. in the winter months.

5–8. Filth, ashes, rubbish, etc., must be carried through the streets in covered carts, and special restrictions are to be made as to temporary depôts for the refuse, their distance from houses (usually 100 yards distance prescribed), and the length of time during which the refuse is allowed to remain in them (usually twenty-four hours made the limit).

9. Where filth from cesspools or privies is deposited for agricultural purposes, the distance from the nearest inhabited premises must be at least 100 yards, and the filth must be forthwith ploughed in or covered with mould.

10. Pigs must not be kept nor swine-dung deposited within 100 feet from any dwelling-house, or so as to pollute any water supply.

In some districts a minimum distance of 60 feet may be entertained.

11. Cattle must not be kept nor their dung deposited in such a situation as to pollute any water used for drinking or domestic purposes or in a dairy.

12. Premises for horses, cattle, or swine must be provided with a suitable receptacle for manure or other offensive matter produced by the keeping of such animals. The bottom of this receptacle must not be lower than the surface of the adjoining ground. The receptacle must be constructed so as to prevent any soakage from it, and must be furnished with a suitable cover. It must also be efficiently drained so as to convey all urine and liquid filth into a sewer or cesspool.

The contents of the receptacle must once at least in each week be effectually removed.

Summary of Model Bye-Laws as to New Streets and Buildings.—*Streets.*—4. Every new street intended for use as a carriage-road shall be at least 36 feet wide.

5. Every new street exceeding 100 feet in length shall be constructed so that it may be used as a carriage-road.

6. Every new street under 100 feet long, and not intended for use as a carriage-road, shall be at least 24 feet wide, except where the proposed new street is not the principal means of approach to any building, but is intended for use for the purpose of removal of house-refuse from any building.

7. Every new street for use as a carriage-road (*a*) shall have a carriage-way at least 24 feet wide; (*b*) the road shall be convex laterally, sloping towards the channels at its sides, at the rate of three-eighths to three-quarters of an inch fall for every foot of the width of the carriage-way; (*c*) the footway shall be at least one-sixth of the entire width of the street, and shall slope towards the kerb or outer edge; (*d*) the height of the kerbing shall be at least three inches and not more than seven inches above the channel of the carriage-way.

8. Every new street must be provided at one end at least with an entrance of a width equal to the width of the street.

Walls, Foundations, and Chimneys.—9. No new building may be erected on a site impregnated with fæcal or any vegetable or animal matter, until this has been properly removed by excavation or otherwise.

10. The whole ground under a new house must be asphalted or covered with a layer of good cement concrete at least six inches thick.

10*a*. Where the intended site of a new building has been excavated, if it is necessary to fill it up, this must be done with sound and suitable material, so as to form a stable and healthy substratum for the foundation.

11. The walls of every new building must be constructed of good bricks,

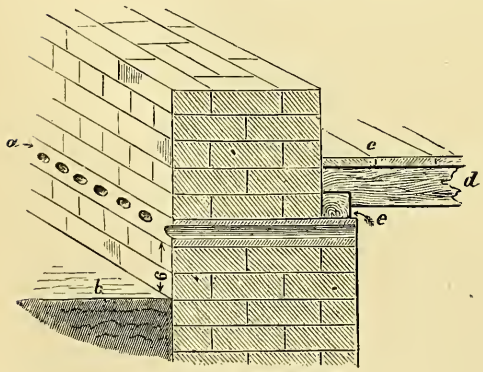


FIG. 7.

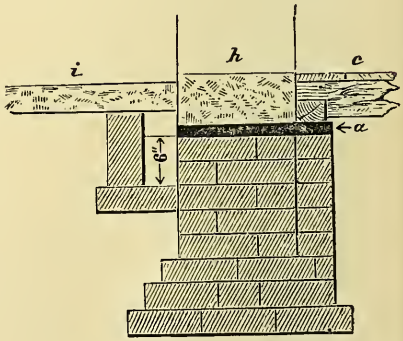


FIG. 8.

a. Damp-proof course. *b*. Level of ground. *c*. Floor-boards. *d*. Floor-joist. *e*. Timber-plate. *f*. Vertical space in wall (Fig. 9). *g*. Concrete. *h*. Doorway. *i*. Pavement of street.

stones, or other hard and incombustible materials, properly bonded and solidly put together (*a*) with good mortar; (*b*) with good cement; or (*c*) with good cement mixed with clean sharp sand.

12–15. The walls must be true and plumb; they must be properly bonded together at the angles, and must rest on proper footings.

16. The footings of every wall must rest on the solid ground, or upon a sufficient thickness of good ground.

17. Every wall of a new building must have a proper damp-proof course of sheet-lead, asphalte, or slates laid in cement, or of other durable material impervious to moisture, beneath the level of the lowest timbers, and at least six inches above the surface of the adjoining ground (Figs. 7 and 8).

Fig. 7 shows the proper arrangement when there is no basement.

Fig. 8 shows the arrangement of damp-proof course, with dry area beneath, when for business purposes it is desirable to avoid a step, and the outside ground is at about the same level as the floor of the house.

Fig. 9 shows the arrangement that should be insisted upon when the walls of the lowest storey are below the ground-level, and are in actual contact with the soil. There should be two damp-proof courses (*a a* Fig. 9), with a double wall between having a cavity in its middle. This middle cavity might be filled with asphalte if the ground is very damp.

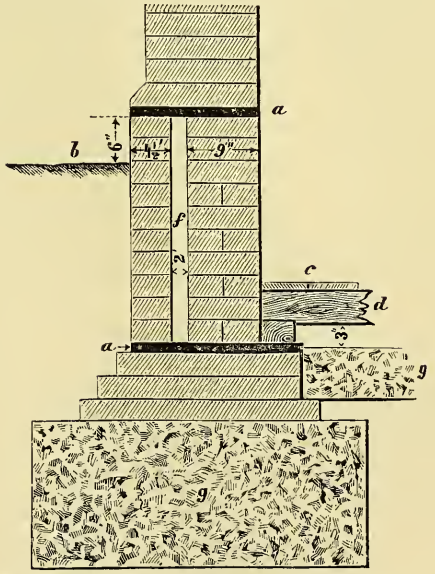


FIG. 9.—DAMP PROOF AND FOUNDATION OF HOUSE, WITH BASEMENT.
(The lettering is the same as for Figs. 7 and 8.)

28. The party walls between buildings must not be so constructed that any opening is left in them.

The model bye-laws 18–52 deal chiefly with the thickness of walls, the construction of chimneys, the absence of timber from flues, the covering of

roofs with incombustible materials, the provision of eaves guttering to roofs, so as to ensure stability, dryness, and safety from fire.

Open Space about Buildings and Ventilation.—53. Every new house shall have throughout its whole line of frontage a free space of at least 24 feet.

54. At the rear of every new house there must be exclusively belonging to it an open space of at least 150 square feet, and free from any building except a water-closet and ashpit. This open space must extend laterally throughout the entire width of the house, and the distance across the open space from the house to the boundary of any adjoining lands and premises (*a*) must not be less than 10 feet in any case; (*b*) if the house is 15 feet high, must be at least 15 feet; (*c*) if the house is 25 feet high, must be at least 20 feet; and (*d*) if exceeding 35 feet high the distance must be at least 25 feet.

This height is measured from the ground-level of the open space to the level of half the vertical height of the roof or to the top of the parapet, whichever may be the higher.

55. A sufficient number of windows must be provided in each storey overlooking the open spaces in front and back of the building.

56. Between the upper surface of the asphalte or concrete (*g*) laid over the ground (see clause 10) and the joists (*d*. Fig. 9), there must be a space at least three inches high, which should be thoroughly ventilated by suitable and sufficient air-bricks, or by some other effectual method.

57. Every habitable room must have at least one window opening directly into the external air, with a total area clear of the sash-frames equal at least to one-tenth of the floor-area of the room. One-half of the window at the least must be constructed so that it may be opened as far as the top of the window.

58. Rooms without an open fireplace must be provided with an aperture or air-shaft of an unobstructed sectional area of at least 100 square inches.

59. Public buildings must be provided with adequate means of ventilation.

Drainage of Buildings.—60. The subsoil under new buildings must be

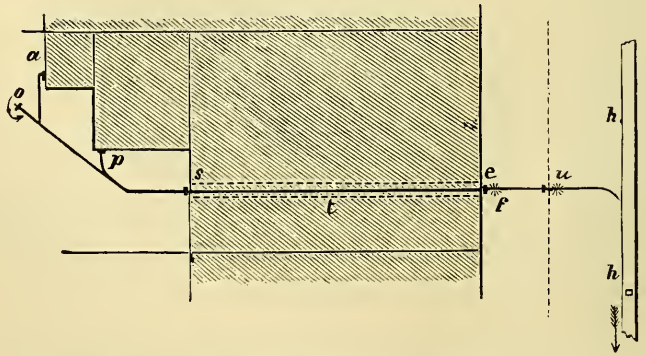


FIG. 10.—SCHEME OF THE DRAINAGE OF A HOUSE FORMING ONE OF A TERRACE (PLAN). *For lettering see Fig.* 11.

effectually drained by earthenware field-pipes, properly laid to a suitable outfall, when the dampness of the site renders such a precaution necessary. The subsoil drains are not allowed to communicate directly with any cesspool or sewer, but must be disconnected by a trap with a ventilating opening between the trap and the subsoil drain.

60*a*. Rain-water pipes are to be arranged so as to carry off water without causing dampness to the walls or foundation of the house.

61. The basement of a new house must be at such a level as to allow of its effectual drainage into the sewer.

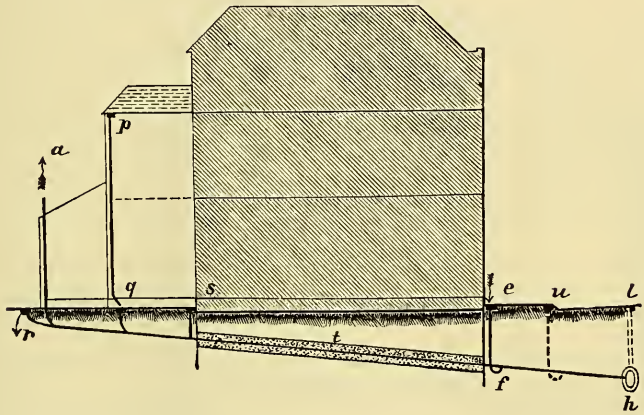


FIG. 11.—SCHEME OF THE DRAINAGE OF THE SAME HOUSE (SECTION).

a. Ventilating pipe from upper end of drain.[1] *e*. Inlet-ventilator. *f*. Intercepting-trap. *h*. Sewer. *l*. Sewer-ventilator. *o*. and *r*. Gully-trap for surface-water. *p*. Rain-water pipe. *q*. Gully-trap, over which rain-water pipe discharges. *s*.[2] Drain-ventilator for portion of drain beneath the house. *t*. Drain under the house, laid in concrete. *u*. Alternative position for inlet-ventilator at kerb of pavement.[3]

62. Every drain other than a subsoil drain must be made of sound pipes of glazed earthenware, or other equally suitable material. It must be of adequate size; and if intended for conveying sewage, have an internal diameter of not less than four inches, and be laid in a bed of good concrete, with a proper fall, and with watertight joints.

The drain may only pass under the house when any other course is impracticable, and in such a case there must be a distance equal to the

[1] This pipe should not terminate, as shown in the diagram, below the level of back windows of the house, but should be continued upwards above the eaves. Bends, if necessary, should be of as easy a curve as practicable.

[2] This drain-ventilator is unnecessary, and it should not be allowed to terminate at the ground-level, as shown in the Figure.

[3] There should be an open area or garden in front of every house, to allow of the inlet-ventilator and intercepting trap being placed within the curtilage of the house, for convenience of access. The arrangements shown at *e* and *u* are objectionable in this respect, as the house abuts immediately on the street.

diameter of the drain between its highest point and the surface of the ground under the building. Drains under houses must be laid in a direct line, and be completely embedded in and covered with good solid concrete at least six inches thick all round. All inlets to the drain, except for ventilating it, must be properly trapped.

In Fig. 12 the arrangement of waste-pipes and ventilators is shown.

Where a constant service of water is supplied, the cistern shown at *b* is unnecessary, thus obviating the dangers connected with the storage of water.

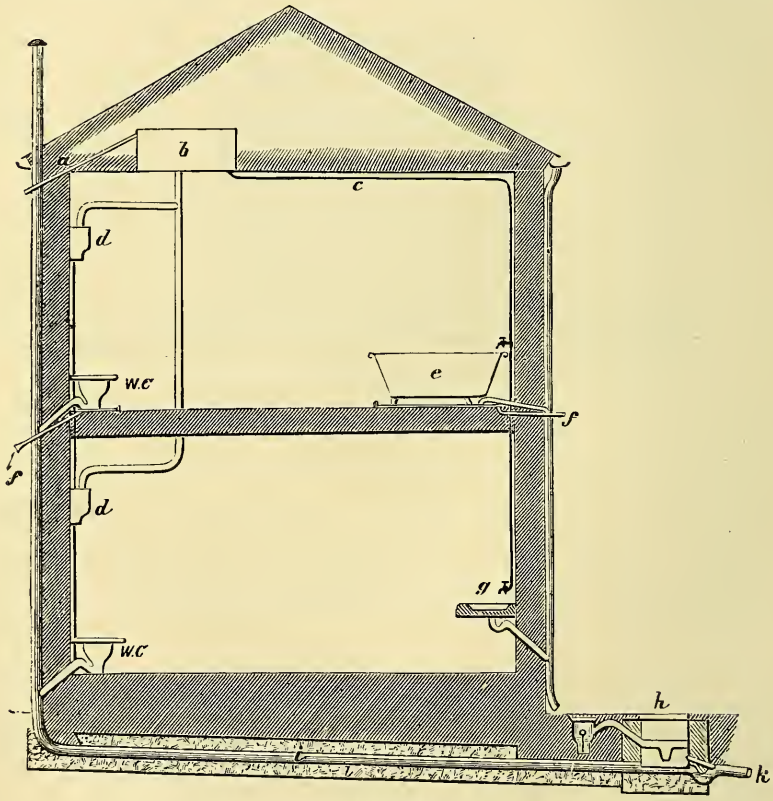


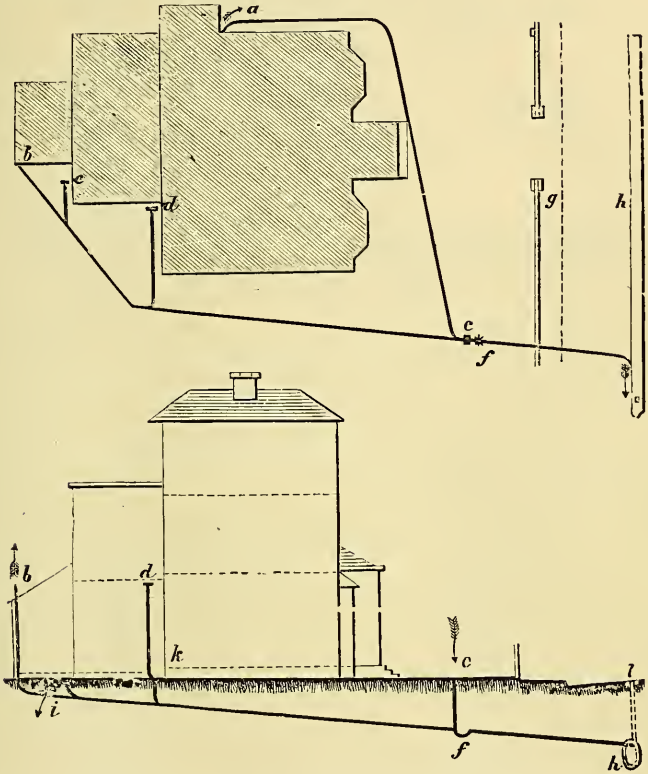
FIG. 12.—SANITARY ARRANGEMENTS OF A HOUSE.

a. Overflow pipe from cistern. *b*. Supply-cistern. *c*. Supply pipe to bath and sink. *d*. Flushing cistern for W.C. *e*. Bath. *f*. Overflow pipe from safe under bath. *g*. Sink. *h*. Manhole.[1] *i*. Drain-pipe under house. *k*. Drain beyond intercepting trap going on to sewer. *l*. Overflow pipe from safe under closet.

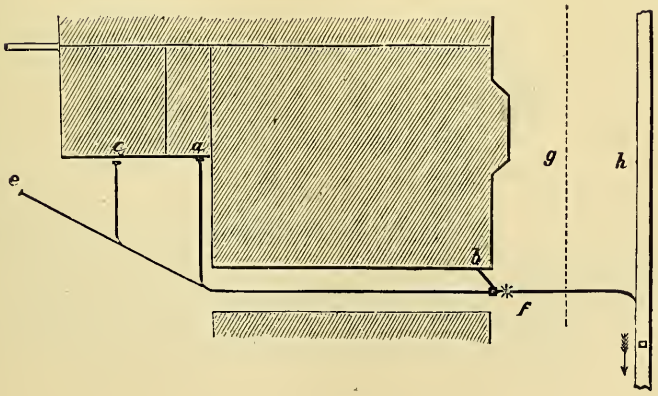
Besides drain-pipes of glazed earthenware, glass or cement pipes have been also employed, as also iron pipes with lead joints, the last being coated with some preparation to prevent their rusting.

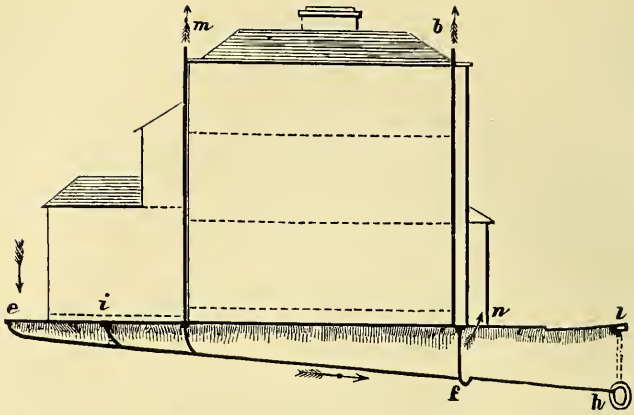
[1] The surface trap at the front of the house should join the drain by a special branched junction, and not discharge into the manhole as shown in the figure.

63. Every house-drain shall be trapped as near as practicable to its junction with the public sewer.



FIGS. 13 AND 14.—SCHEME OF THE DRAINAGE OF A DETACHED HOUSE (PLAN AND ELEVATION).
(*Scale*, 1 *inch to* 15 *feet.*)





FIGS. 15 AND 16.—SCHEME OF THE DRAINAGE OF A SEMI-DETACHED HOUSE (PLAN AND ELEVATION).

(*Scale*, 1 *inch to* 15 *feet.*)

Explanation of lettering of figs. 14, 15, 16.—*a.* Soil-pipe ventilator. *b.* Drain-ventilator (outlet).[1] *c.* Sink in wash-house. *d.* Bath. *e.* Drain-ventilator (inlet). *f.* Disconnecting-trap. *g.* Footpath. *h.* Sewer. *i.* Trapped gully. *k.* Trapped gully for disconnecting bath-waste. *l.* Sewer-ventilator. *m.* Soil-pipe ventilator. *n.* Covered inspection shaft to trap.

Figures 11, 12, 13, 14, 15 and 16 show clearly the arrangements for preventing the entry of sewer-gases into the house. It should be noted that in Fig. 14 the inlet-ventilator is in front of the house (an arrangement which is the most general in practice), while in Fig. 16 the inlet-ventilator is at the back of the house.

It is forbidden to ventilate house-drains by means of drain-pipes or by rain-water pipes.

The syphon A shown in Fig. 17 is a good form of intercepting trap for disconnecting the house-drain from the sewer. It has a flat external bottom, which ensures its being fixed level. At B is shown a very bad form of intercepting-trap, now seldom employed.

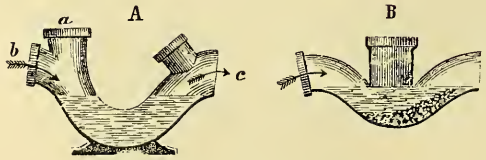


FIG. 17.—SYPHON TRAP.

A. *a.* Point of connection of inlet-ventilator. *b.* Junction with house-drain. *c.* Outlet from trap to sewer.

B. A bad form of intercepting-trap, the central vertical shaft allowing accumulations to occur, and cleansing being difficult.

[1] Refer to footnote on the same arrangement in Fig. 11.

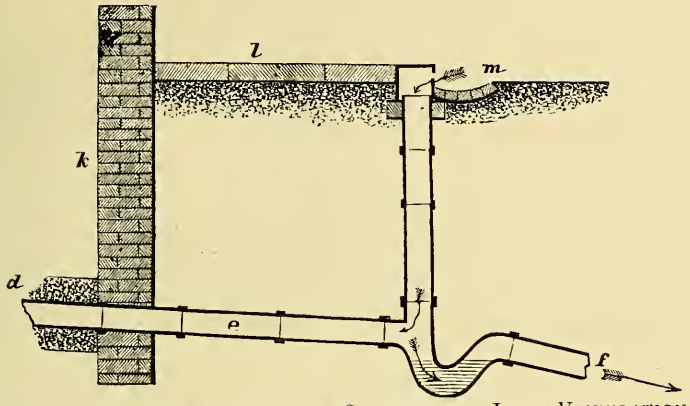


FIG. 18.—ARRANGEMENT OF THE SYPHON WITH INLET-VENTILATION.

In modern houses space is always left between the front of the house and the pavement, thus allowing the inlet-ventilator and the intercepting-trap to be placed within the curtilage of the house. The arrangement actually shown in Fig. 18 is therefore only rarely followed, though the principle of inlet-ventilation is the same.

d. Concrete about drain. *e*. Six-inch drain. *f*. Drain-pipe going to sewer.
k. House-wall. *m*. Air-inlet in kerb.

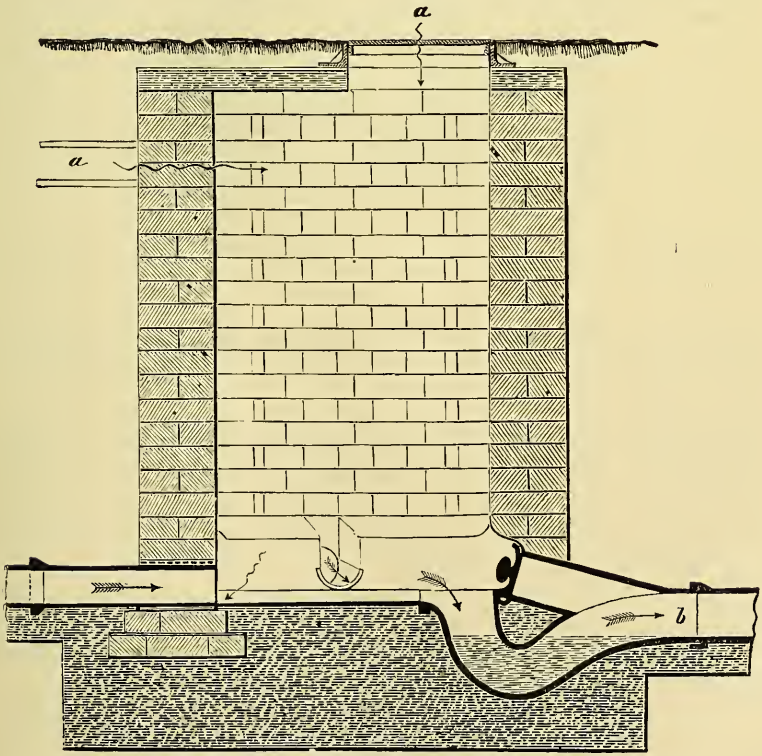


FIG. 19.—SECTION OF INSPECTION CHAMBER.

The openings of ventilating pipes should be constructed so as to prevent the entry of anything which might block them, without interfering with the passage of air. The total free surface of the gratings should not be less in area than that of the section of the ventilating-pipe, and the latter should he as wide as the soil-pipe. Curves and angles should be as far as practicable avoided.

An inspection chamber should be placed at the point of entry of fresh air into the drain. If two or more drain-pipes join together, it is necessary to have an inspection chamber at their junction. By this means the examination of the drainage is facilitated, and its sanitary condition rendered more secure. Figures 19 and 20 show an inspection chamber, with a branch *c* opening obliquely into the channel *d*. The inlet-ventilator also opens into the manhole, either above or laterally.

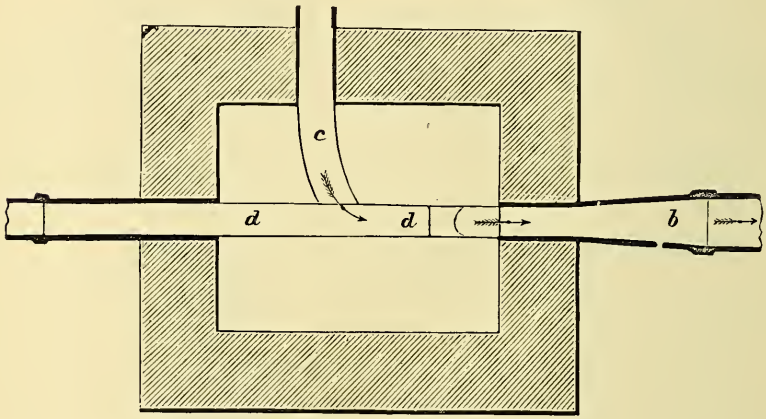


FIG. 20.—PLAN OF INSPECTION CHAMBER.

a. (Fig. 19) Inlet for fresh air. *b*. Main drain leading to sewer. *c*. Branch drain. *d*. Channel drain.

64. No right-angled junctions to drains, either vertical or horizontal, are permitted. Every branch drain must join another obliquely in the direction of the flow in the latter (Fig. 20).

Right-angled junctions are a frequent cause of deposit of solid matters. Pipes specially made for this purpose must be employed for junctions.

65. In order to secure efficient ventilation of house-drains, the house-drain must be ventilated at both ends. The inlet-ventilator is to be placed on the house side of the intercepting-trap (Fig. 14). The outlet-ventilator should be as far from the inlet as possible, and should be carried up above all windows, and be at least ten feet high in every case (Fig. 14 and 16).

If this arrangement presents any difficulties, the outlet ventilation can be arranged in front of the house, the other extremity of the drain serving as an inlet (Fig. 16).

A continuation upwards of the soil-pipe may be used as a drain-ventilator (Fig. 16).

Note that the ventilation of the house-drain is dealt with above, and not that of the sewer, which latter ought to be quite distinct.

Ventilating-pipes should have the fewest possible curves and angles. It is estimated that a pipe bent at right angles loses 50 per cent. of its current of air.

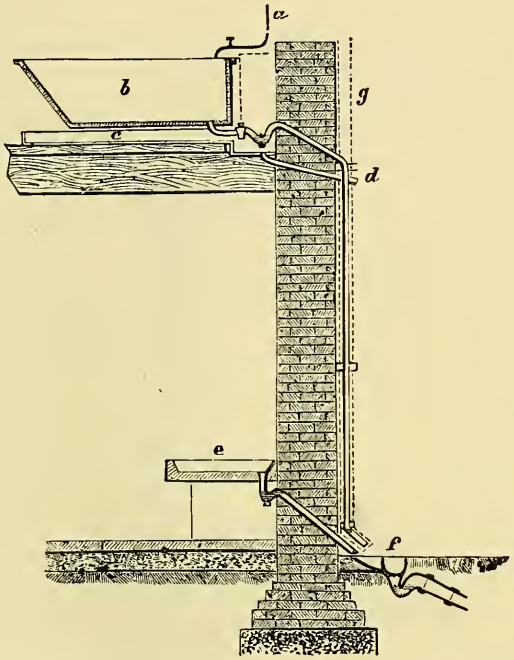


FIG. 21.—WASTE-PIPES OF A HOUSE.

(*Scale $\frac{3}{32}$ inch to every 4 feet.*)

a. Water supply. *b*. Bath. *c*. Safe. *d*. Overflow pipe from *c*. *e*. Sink. *f*. Point of discharge of waste-pipes over gully-trap. *g*. Rain-water pipe opening over gully-trap.

66. No inlets to drains are allowed within houses. The soil pipe must be at least four inches in diameter and be fixed outside the building and continued upwards without diminution of its diameter, and except where unavoidable without any bend or angle to such a height and position as to afford, by means of its open end, a safe outlet for sewer-air (Fig. 16).

No trap is allowed at the foot of the soil-pipe or elsewhere in its course, except as part of the water-closet apparatus (Fig. 12).

All waste pipes from baths, sinks (except slop-sinks) or lavatories, and overflow pipes, must be taken through an external wall of the house, and made to discharge in the open air over a channel leading to a trapped gully grating at least 18 inches distant (Fig. 12).

The waste-pipe from a slop-sink for carrying off liquid or solid filth is to be constructed and ventilated like a soil-pipe.

The object of these regulations is obviously to prevent the entrance of drain-air into houses.

When a waste-pipe in a basement storey cannot be made to discharge in the open air as described above, owing to there being no area outside, the arrangement shown in Fig. 22 has been suggested by Mr. Rogers Field. At the bottom of the trap is an iron bucket (tarred and sanded to prevent rust). Grease and sediment may be removed by means of the long handle provided.

A preferable arrangement to this would be to make the waste-pipe discharge over a gully-trap fixed in the floor of the basement, great care being taken that the trap should be properly fixed, the joint securely made, and the trap easily accessible for cleansing. Sinks in basements without areas outside should be avoided where practicable.

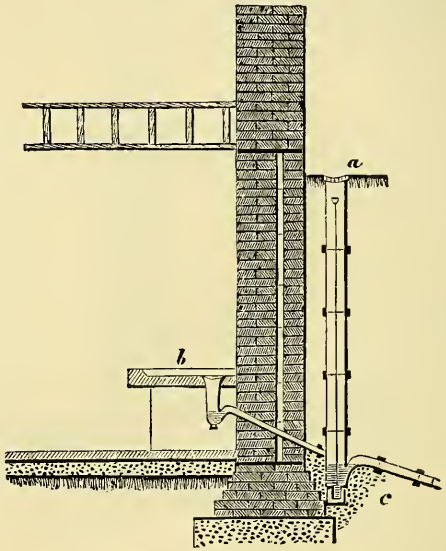


FIG. 22.—ARRANGEMENT OF WASTE-PIPE FROM SINK IN A BASEMENT WITHOUT AREA.

(*Scale*, $\frac{3}{8}$ *inch to* 4 *feet.*)

a. Grating. *b*. Sink. *c*. Iron bucket with handle.

Water-Closets.—67. Water-closets or earth-closets within houses must be so placed that at least one of their sides shall form an external wall.

68. They shall have on one wall a window of not less than 2 feet by 1 foot in dimensions, exclusive of the frame, and opening directly into the external air, and in addition have permanent ventilation by means of at least one air-brick or by an air-shaft.

Every water-closet shall be supplied with a special cistern for flushing purposes, not used for any other purpose. This must be of such a character as to secure a prompt and effectual removal from the pan of the closet of all filth.

The pan of the closet should be of non-absorbent material, and so constructed as to contain a sufficient quantity of water, and that all filth may fall free of the sides of the pan and directly into the water.

There must not be under the pan any "container" or "D trap."

Earth-Closets.—70. Every earth-closet must have a receptacle for dry earth or other deodorising substance, arranged so that easy access may be obtained for putting these in it. There must be suitable means or apparatus for applying the dry earth to filth deposited in the receptacle for filth of the closet.

71. When an earth-closet has a fixed receptacle for filth, the latter must be so placed as to allow of the application of dry earth, and of ready access for removing the contents. The receptacle should be large enough for a period not exceeding three months, its capacity not exceeding 40 cubic feet. It should be constructed so as to prevent the absorption or leakage of any filth ; and the bottom of the receptacle should be at least 3 inches above the level of the adjoining ground. The percolation of rain-water, or the drainage of any waste water into it should not be possible.

72. Earth-closets provided with movable receptacles for filth should have similar arrangements to the above for deodorising.

The receptacle in this case should not exceed 2 cubic feet in capacity.

Privies.—73. Privies should be at least 6 feet from any house or place of business or meeting.

74. They should be at least 40 to 50 feet from any well, spring, or stream of water likely to be used for drinking.

This distance is probably insufficient in many cases to ensure freedom from danger.

75. Ready means of access should be provided for every privy, so as to allow of cleansing and removal of filth without its being carried through any house.

Other forms of closet must be adopted where there is no back street or passage through the house.

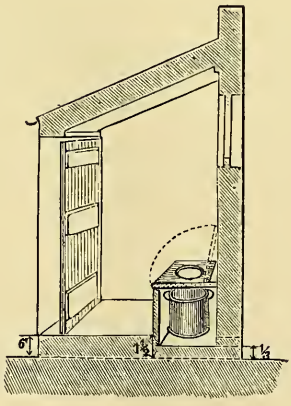


FIG. 23.—SECTIONAL VIEW OF A PAIL-CLOSET.

76. Privies must be furnished with ventilating openings into the external air, as near the top as possible. The floors should be paved with non-

absorbent material, with every part at least 6 inches above the level of the adjoining ground, and the floor having an inclination towards the door of the privy of half an inch to the foot.

77. For privies in which movable receptacles for filth are employed, the floor beneath the seat must be paved as before. The space under the seat must be so constructed as to admit a movable receptacle capable of holding not more than 2 cubic feet of filth, so placed as to prevent fouling of any other part of the space.

The seat must be so constructed as to allow of easy access to the space beneath it.

78. Privies with fixed receptacles must be provided with means for the frequent and effectual application of ashes, or other dry refuse to the filth. They must be so constructed as not to be exposed to rainfall or the drainage of any waste water.

The receptacle must consist of non-absorbent material, and have its floor at least 3 inches above the level of the adjoining ground, and its total capacity not exceeding 8 cubic feet. Adequate means of access must be provided for cleansing the receptacle.

The limit of size goes far towards ensuring a weekly scavenging.

79. No part of a privy must have a direct communication with any drain.

Ashpits.—80. Ashpits must be at least 6 feet away from any house.

81–2. They should be at least 30 to 40 feet away from any source of drinking water; and should be so constructed and placed as to afford ready access for cleansing, without having their contents carried through any house.

83. Their capacity should not exceed 6 cubic feet, or for a period not exceeding one week.

84. Every ashpit should be made of flagging and slate, or brickwork at least 9 inches thick rendered inside with cement. The floor must be not less than 3 inches above the adjoining ground, and be flagged or asphalted. The ashpit must be roofed over, and have a door for the convenient removal of contents, capable of being securely closed.

85. The ashpit must not communicate with any drain.

Cesspools.—86. Every cesspool should be at least 50 feet from any dwelling-house.

Cesspools are only permissible in sparsely populated districts, where no public sewers are provided. They are liable to be a source of danger by the accumulation of filth in the neighbourhood of houses, and by the possible contamination of drinking-water.

87. Every cesspool should be at least 60 to 80 feet from the nearest well, stream, or other source of drinking-water.

It is doubtful if this distance suffices in all cases.

88. Ready means must be provided for emptying cesspools without conveying their contents through any house.

Cesspools must not have an outlet communicating with any sewer.

This bye-law ensures that no cesspools shall be allowed where a public system of sewerage is available.

89. Every cesspool must be built of good brickwork in cement, rendered inside with cement, and with a backing of at least 9 inches of well-puddled clay around and beneath the brickwork.

It should be properly covered over and be adequately ventilated.

Houses unfit for Human Habitation.—90. The Sanitary Authority are enabled to have any building, or part thereof, which is shown to be unfit for human habitation, closed against such use until the owner upon whom the following notice is served has made it fit for habitation; and to prevent any person from inhabiting such house, until it has been made fit for habitation.

The owner has a right to be heard in defence of his interests, before this bye-law can be carried out, as indicated in the following notice which is served upon him:—

[*Form of Notice.*]

DISTRICT OF

To of

Whereas, by a statement in writing under the hand of Medical Officer of Health for the said District (or the Surveyor), of which statement a copy is contained in the Schedule hereunto annexed, it has been certified to the said sanitary authority that a certain building or part of a building, situate at in the said district, is unfit for human habitation;

And whereas it has been shown to the said sanitary authority that you are the owner of such building or part of a building;

Now I the Clerk of the said sanitary authority, do hereby give you notice that unless on or before the day of 18 , by a statement in writing under your hand, or under the hand of an agent duly authorised by you in that behalf, and addressed to and duly served upon the said sanitary authority by being delivered to me, you shall show to the said sanitary authority sufficient cause why such building or part of a building shall not be declared unfit for human habitation, the said sanitary authority in pursuance of the powers conferred upon them in that behalf will, by an order of writing under their seal, declare that such building or part of a building is unfit for human habitation, and direct that, unless and until such building or part of a building shall have been rendered fit for human habitation, the same shall be closed, and the use thereof for human habitation shall be prohibited.

Witness my hand this day of in the year One thousand eight hundred and

Clerk to the Sanitary Authority.

Control of the Erection of New Houses.—92. Every person intending to erect a building must give written notice to the sanitary authority of his intention, accompanied by plans and sections of every floor of the intended building, on a scale of not less than 1 inch to every 8 feet, showing the details of construction, especially of every closet, cesspool, well, etc.

The plans, etc., must be accompanied by a description in writing of the materials intended to be used, and of the intended mode of drainage and means of water-supply; and also by a block plan of the building on a scale

of not less than 1 inch to every 44 feet, which shall show the position of adjoining buildings, the width and level of the street in front, the level of the lowest floor of the new building, and of any yard belonging to it. This plan should show the intended line of drainage of the house, the intended size, depth, and inclination of the drain, and the details of the arrangement proposed for ventilating the drain.

93. Notice must be given to the surveyor of the sanitary authority of the date on which it is intended to begin to erect any new house. No drain or foundation of a building is allowed to be covered up without previous notice having been given to the surveyor.

Any work which contrary to this bye-law is covered up, or so far completed as to prevent due inspection, may, by order of the Surveyor, be exposed or pulled down to satisfy him that it is in accordance with the bye-laws.

94.—The Surveyor of the Sanitary Authority must be afforded access to the work in connection with any new house during its progress, for the purpose of inspection.

96–97. The Surveyor ought to have written notice sent to him on the completion of any new street or building, so that he may have an opportunity of again inspecting them.

98. Penalties are incurred by infringing any of the previous bye-laws.

99, When any work has been done in contravention of the bye-laws, the Sanitary Authority is empowered to remove, alter, or pull down the work, unless the owner shows sufficient cause why this should not be done.

Common Lodging-Houses.—For the regulations contained in the Public Health Act respecting Common Lodging-Houses, see p. 28. In addition to the general sanitary requirements for all dwelling-houses, the Model Bye-laws of the Local Government Board prescribe the following regulations :—

1. The keeper of a common lodging-house shall not receive a greater number than is fixed by the sanitary authority as the maximum number allowed and specified in the following form of notice to the keeper :—

[*Form of Notice.*]

To of

Whereas in pursuance of the statutory provision in that behalf, you have been duly registered by the Sanitary Authority for the district of as the keeper of a common lodging-house situated at in the said district. Now I, Clerk to the said Sanitary Authority, do hereby give you notice that, in the exercise of the powers conferred upon them in that behalf, the said Sanitary Authority have fixed as the maximum number of lodgers authorised to be received at any one time into such house and into the several rooms therein the number specified in respect of such house and of each of such rooms in the Schedule hereunto appended.

SCHEDULE.

The Sanitary District of
Common Lodging House situated at
Name of Keeper

The maximum number of lodgers authorised to be received at any time into this house is The maximum number of lodgers authorised to be received at any one time into each of the several rooms in this house is the number specified in respect of such room in the appropriate column of the following table:—

	Description or number of room.	Dimensions or cubical contents of room.	Maximum number of lodgers.
Ground storey	...	...	...
First storey	...	...	...
Second storey	...	...	...
Topmost storey	...	...	...

For the purposes of this notice, every two children under the age of *ten years* may be counted as one lodger.

Witness my hand this day of 18

Clerk to the Sanitary Authority.

3. No person of the male sex over 10 years of age is allowed to occupy any bedroom occupied by females; and conversely for females.

Married couples are not included in this regulation; but no person of either sex over 10 years of age must occupy the same apartment as a man and his wife.

4. Every apartment used by a married couple must be effectually screened by a solid partition from the occupants of any other bed, the partition reaching throughout the whole length and breadth of the bed (adequate means of access to the bed being left), to a sufficient height above the bed, and not being more than 6 inches from the floor below.

5. The keeper must cause every yard and open space about the premises to be kept clean and in good order.

6. The floors and passages of every room must be swept each day before 10 a.m., and washed once a week.

7. Every window and fixture of stone and wood must be periodically cleansed.

8. The bedclothes, bedding, and bedsteads must be kept in a clean and wholesome condition.

9. A sufficient supply of basins, water, and towels must be provided for the lodgers, and kept in a cleanly condition.

10. All solid or liquid filth or refuse must be removed daily before 10 a.m. from every room, and the utensils thoroughly cleansed.

11. The seat, floor, and walls of every water-closet or privy belonging to the house must be kept in a clean and wholesome condition.

12. The water-closet and its apparatus, and the drain connected with it, must be kept in good order and efficient action.

13. If there is any earth-closet or privy belonging to the house, it must be kept in a wholesome condition, and dry earth or other deodorizer provided.

14. The same regulation applies to ashpits.

15. All means of ventilation must be kept in efficient action.

16. All the windows of bedrooms must be kept fully open for at least one hour in the forenoon, and one hour in the afternoon of every day, unless the state of the weather forbids this, or a bed in the room in question is occupied in consequence of sickness or of other sufficient cause.

17. The bedclothes of every bed must be removed as soon as practicable after occupation of the bed, and exposed to the air for at least one hour every day.

18. The keeper, if any lodger is ill from any infectious disease, must adopt all necessary precautions against its spread; and the same room must not be occupied by any other person. When so ordered by the Sanitary Authority, he must take all the necessary steps for securing the removal of such patient to a hospital, and carry out all the necessary measures prescribed by the Medical Officer of Health. He may be required to cease to receive any lodger for a specified time, and must see to the carrying out of the necessary cleansing and disinfecting.

19. The room employed as a scullery or kitchen must not be used as a sleeping apartment.

20. No bed must be occupied by more than one person of the male sex above the age of ten years.

21. No bed may be occupied within eight hours of the time it was vacated by the preceding occupant of it.

22. Every room must be furnished with sufficient beds, bedclothes, and the necessary utensils for the number of persons allowed in it.

23 and 24. The keeper must affix in a conspicuous position in each room any placards supplied by the Sanitary Authority stating the maximum number of lodgers for each room; and must also exhibit a copy of the bye-laws in force when supplied with it.

The keeper of the common lodging-house is made the responsible party in the event of breach of any of these regulations.

Seamen's Lodging Houses.—For lodging-houses for the use of seamen in ports, there are regulations in the *Merchant Shipping Acts* of 1854 and 1883. According to these regulations, the Sanitary Authority of each port should make local bye-laws, for which the confirmation of the Board of Trade is required. These should state the conditions under which such lodging-houses may be opened and inspected, regulations as to their sanitary condition, and the measures to be taken to prevent the opening of non-registered lodging-houses.

If the Local Authority fails to make the required bye-laws, they are made by the president of the Board of Trade.

Slaughter-Houses.—The model bye-laws of the Local Government Board require that:—

1. Every person who shall apply to the Sanitary Authority for a licence for the erection of any premises to be used and occupied as a slaughter-house shall furnish in the form hereunto appended a true statement of the particulars therein required to be specified.

FORM OF APPLICATION FOR A LICENCE TO ERECT PREMISES FOR USE AND OCCUPATION AS A SLAUGHTER-HOUSE.

To the Sanitary Authority for the District of .

I, , of , , do hereby apply to you for a licence, in pursuance of the statutory provisions in that behalf, for the erection of certain premises to be used and occupied as a slaughter-house ; and I do hereby declare that to the best of my knowledge and belief the Schedule hereunto annexed contains a true statement of the several particulars therein set forth with respect to the said premises.

SCHEDULE.

1. Boundaries, area, and description of the proposed site of the premises to be erected for use and occupation as a slaughter-house.	
2. Description of the premises to be erected on such site:— (*a*) Nature, position, form, superficial area and cubical contents of the several buildings therein comprised. (*b*) Extent of paved area in such buildings, and materials to be employed in the paving of such area. (*c*) Mode of construction of the internal surface of the walls of such buildings, and materials to be employed in such construction. (*d*) Means of water supply,—position, form, material, mode of construction, and capacity of the several cisterns, tanks, or other receptacles for water to be constructed for permanent use in or upon the premises. (*e*) Means of drainage, — position, size, materials, and mode of construction of the several drains. (*f*) Means of lighting and ventilation. (*g*) Means of access for cattle from the nearest street or public thoroughfare. (*h*) Number, position, and dimensions of the several stalls, pens, or lairs to be provided on the premises. (*i*) Number of animals for which accommodation will be provided in such stalls, pens, or lairs, distinguishing— 1. Oxen. 2. Calves. 3. Sheep or lambs. 4. Swine.	

Witness my hand this day of 18

(*Signature of Applicant.*)

(*Address of Applicant.*)

2. Application must be similarly made when a licence is required for the use and occupation of any premises as a slaughter-house.

3 and 4. Every person to whom the Sanitary Authority decides to grant a licence to erect premises as a slaughter-house is entitled to receive from the Sanitary Authority a licence in the appended form.

FORM OF LICENCE TO ERECT PREMISES FOR USE AND OCCUPATION AS A SLAUGHTER-HOUSE.

No. of Licence .

Reference to Folio in Register .

District of .

Whereas application has been made to us, the Sanitary Authority for the district of , by , of , , for a licence to erect on a site within the said district certain premises for use and occupation as a slaughter-house :

Now, we, the said Sanitary Authority, in pursuance of the powers conferred upon us by the statutory provisions in that behalf, do hereby license the said , of , , to erect for use and occupation as a slaughter-house upon the site defined or described in the Schedule hereunto annexed the premises whereof the description is set forth in the said Schedule.

SCHEDULE.

Boundaries, area, and description of the proposed site of the premises to be erected for use and occupation as a slaughter-house.	Description of the premises to be erected for use and occupation as a slaughter-house.

L. S.

Given under the Common Seal of the Sanitary Authority for the district of , this day of , in the year One thousand eight hundred and

Clerk to the Sanitary Authority.

A similar licence is to be given in the case of an application for the use and occupation of existing premises as a slaughter-house, where the Sanitary Authority has decided to grant a licence.

5. Every person who has obtained a licence from the Sanitary Authority to erect any premises for use as a slaughter-house, shall register such premises at the office of the Sanitary Authority, it being the duty of the Clerk to the Sanitary Authority to enter the particulars given in the accompanying schedule, in a book provided for this purpose.

FORM OF REGISTER OF SLAUGHTER-HOUSES.

District of .

Folio .

Date of registration.	Date of licence.	No. of licence.	Christian name, surname, and address of owner or proprietor of slaughter-house.	Christian name, surname, and address of occupier of slaughter-house.	Situation of slaughter-house.	Number of animals for which accommodation is provided on the premises.			

6. The occupier of a slaughter-house must afford at all reasonable times free access to the officers of the Sanitary Authority, for the purpose of inspecting the premises.

7. He must provide every animal in the lair with a sufficient quantity of wholesome water.

8. The head of each cow or ox must be so secured that it can be felled with as little pain or suffering as possible.

9. The slaughter-house must be efficiently ventilated into the external air; and (10) the drainage must be kept in efficient action.

11. The internal surface of the walls and the floor must be kept in good repair, so as to prevent the absorption of any offensive material. The walls must be washed with hot lime-wash at least four times in every year; and the floors, etc., must be thoroughly washed and cleansed within three hours after the completion of slaughtering.

12. Dogs are not allowed to be kept in the slaughter-house. Cattle may only be kept on the premises, so long as may be necessary for the purpose of preparing them for slaughtering.

13. The hide, fat, and offal of every animal slaughtered on the premises must be removed therefrom within twenty-four hours after the completion of the slaughtering of the animal.

14. A sufficient water supply must be provided.

15. Covered galvanized iron or other receptacles of non-absorbent materials, furnished with closely fitting covers must be provided for the reception of all blood, manure, garbage, or other refuse products of slaughtering. The contents of these receptacles must be removed from the premises at least once in every twenty-four hours, and the receptacles kept thoroughly clean.

16. An offence against any of the preceding bye-laws renders the offender liable to a penalty of £5, and in the case of a continuing offence to a penalty of 10*s.* for every day during which the nuisance continues.

CHAPTER IV.

LONDON.

General Summary.—Sanitary Administration.—Résumé of the Hygiene of the Air.—Methods of Ventilation.—Résumé of the Hygiene of Water.—Arrangements as to Water Supply,—Résumé of the Hygiene of Food.—Sanitary Provisions as to Foods.—Sale of Foods.—The Milk Trade.—Résumé of the Hygiene of the Soil.—Scavenging of London.—Letts' Wharf and Dust Cremator.—Cattle Markets.—Abattoirs.—Résumé of Drainage Systems.—Systems of Water-closets.—General Rules as to the Construction of Sewers.—Purification of Sewage.—Filtration.—The Sewers of London.—The Wimbledon Sewage Farm.—The Croydon Sewage Farm.

General Summary.—London, the greatest city in the world, had a population at the census taken in April, 1891, of 4,231,431.

It stands in portions of three counties—Middlesex, Surrey, and Kent. North of the Thames it is in Middlesex, and on the south of this river in the County of Kent and the western part of the County of Surrey.

The soil consists of a ferruginous brownish-red clay, called the *London clay*, overlaid in some parts by sand or gravel. To the north the ground rises from the Thames to the undulating heights of Hampstead and Highgate; to the west it rises gradually from Westminster, Chelsea, Fulham, and Hammersmith towards Paddington, Hanover Square, St. James's, Westminster, and Marylebone. To the east the ground falls from Shoreditch, Bethnal Green, and Whitechapel towards the lower quarters of St. George-in-the-East, Stepney, Poplar, and Bow, situated on the banks of the Thames and its tributary the Lea. The banks of the Southwark side are occupied by an uninterrupted series of dockyards and warehouses; thence it rises gradually to Norwood, Eltham, and Sydenham.

The mean height of the southern parts of London above the level of high water of the Thames is about 6 feet, that of the eastern parts is 26 feet, of the western parts 27½ feet, and of the northern parts 67½ feet. The mean height of London above the high-water level is about 39 feet.

London is situated nearly 78 miles from the mouth of the Thames; but the tide is felt as far as Teddington, which is over 9 miles to the west.

The superficial area of the County of London is 75,462 acres. The population, enumerated at the census April, 1891, was 4,231,431, averaging 56 per acre. There are 553,764 inhabited houses, each having on an average 7 to 8 occupants.

This small number shows that it is usual in England to have only one family in each house.

The mortality per 1,000 inhabitants has been as follows since the year 1865 :—

1865–69	24·4
1870–74	23·0
1875–79	22·5
1880–14	21·2
1885–88	20·2
1889–90	19·9
1891	21·4

Sanitary Administration.—London has always had a set of enactments separate from those regulating the sanitary condition of other parts of the country. The complex and numerous Acts of Parliament relating to the metropolis have, during the parliamentary session of 1890, been consolidated and amended in the Public Health (London) Act, the special provisions of which are summarised on page 54. This Act brings the metropolis into a line, as regards efficiency of sanitary legislation, with the rest of the country, while in certain respects it gives powers beyond those in the hands of provincial authorities.

The sanitary administration of London, unlike that of the provinces, is not checked in any manner by the Local Government Board. Until 1888 the Central Sanitary Authority in London was the *Metropolitan Board of Works*, there being also the *Metropolitan Asylums Board* for the general control and administration of infectious hospitals and asylums. The former of these bodies is now superseded by the *London County Council*, the latter retains its former powers.

In addition to these central authorities, London is sub-divided into a number of local Sanitary Authorities. The divisions of these authorities correspond with the divisions of parochial (poor-relief) administration ; *i.e.*, with parishes ; but the sanitary and parochial functions are administered by different bodies. The representatives of the public for each parish are elected on the *vestry*. In some parts of London the vestry does not form the local authority ; but representatives from this and neighbouring vestries are elected to act on a *District Board of Works*. There are in London 23 vestries and 15 district board of works. It is almost certain that the boundaries of these districts will be modified, and the elected bodies made more directly representative of the constituencies by the District Councils Bill, which will probably shortly be passed through Parliament.

The number of members of each vestry was fixed in proportion to the population. The number of members of a district board varies in the different districts from 27 to 58. The representatives are elected for three years, one-third retiring each year, though they are eligible for re-election.

The City of London has special privileges of its own, not being directly under the supervision of the London County Council. Its governing municipal body is called the *Corporation of London*, consisting of the Lord Mayor chosen annually, 25 aldermen chosen for life, and 206 common councillors elected annually. The sanitary administration of the city is in

the hands of the *Commission of Sewers*, consisting of 95 members, who are chosen from the aldermen and councillors of the City of London. Its name originated in the earliest sanitary law of England—*The Statute of Sewers*, passed in 1533, in the reign of Henry VIII. The 95 members of the Commission of Sewers are the Lord Mayor, the town clerk, 6 aldermen, and 87 common councillors. The Commission of Sewers acts as the *Port Sanitary Authority* for the Port of London, having the same powers as the port sanitary authorities under the Public Health Act (p. 35).

The *London County Council* was constituted, in common with county councils all over England and Wales, under the Local Government Act of 1888. The City of London forms one of its electoral divisions, like all other districts in London, and sends representatives to it. The County Council comprises a chairman, 19 aldermen, and 118 councillors. The term of office for aldermen is 6 years, for councillors 3 years. The councillors are elected directly by the ratepayers, the aldermen by the councillors.

The powers and duties of the County Council are as follows :—

1. The raising and loaning of money for public purposes ;

2. The main drainage of the metropolis, including precipitation of sewage and the disposal of the sludge ;

3. Sanctioning new sewers constructed by vestries and district boards ;

5. Controlling the fire brigades of the metropolis ;

6. The purchase and maintenance of existing parks and open spaces ;

7. The maintenance of the Thames Embankments, and works for the prevention of flood ;

8. The control of bridges over the Thames within the metropolis, the tunnel under the Thames at Blackwall, and Woolwich ferry ;

9. The inception and carrying out of great street improvements ;

10. The regulation of the width of new streets, lines of building, the naming and numbering of streets, etc ; the appointment of building and district Surveyors ; regulation of dangerous structures, and of buildings unfit for habitation, including action under the Housing of the Working Classes Act, 1890 ;

11. The control of regulations as to cattle diseases, offensive trades, dairies and cow-sheds, tramways, gas testing, and constant supply of water ; licensing of slaughter-houses and of cow-keepers ; and the election of coroners ;

12. The making of bye-laws for the metropolis on various sanitary matters ; and the receiving of reports from local Medical Officers of Health, half of whose salary is paid by the Local Authority, and half by the County Council.

Each parish or district in the metropolis possesses a Medical Officer of Health, one or more Sanitary Inspectors, a Surveyor, an Accountant, and a Clerk, with other subordinate officers. Their duties are the same as in other towns.

The duties of the Vestries and Boards of Works of the metropolis are

to carry out the provisions of the *Local Management Acts* of 1855, 1856, and 1862, and also of the Public Health (London) Act, 1890, and of various special Acts applicable to London as well as to the rest of the country. Speaking broadly, these provisions are similar to those contained in the Public Health Act, 1875, though there are numerous minor differences (see p. 54). The Infectious Disease (Notification) Act, so far as the metropolis is concerned, is incorporated in the Public Health (London) Act.

The Local Government Board was established by the Public Health Act of 1848. In 1858 in connection with an amendment of this Act it ceased to exist, its functions being transferred to the Privy Council, with a Medical Officer as head of the sanitary department. In 1871 these functions were again handed over to the Local Government Board; but London, adhering to the older legislation, still remained under the control of the Privy Council, whose duty it is in the event of a serious epidemic to publish temporary regulations for preventing its spread. These regulations remain valid for six months from the date of issue.

Vaccination, poor-law administration, the General Register Office for Statistics, and the inspection of the metropolitan water supply are, however, under the control of the Local Government Board. The *Metropolis Water Acts*, 1855–71 contain special provisions as to the water supply of London.

Résumé of the Hygiene of the Air.—The air contains in every 100 volumes 20·99 of oxygen, 78·6 of nitrogen, ·033 of carbonic dioxide, and a variable quantity of aqueous vapour. With the exception of aqueous vapour, the constituents of external air vary but little. According to Dr. Angus Smith, the amount of oxygen varies from 20·999 per cent. on the coast of Scotland to 20·910 in the streets of Manchester, while the carbonic dioxide varies from ·03 to ·05 per cent. Dr. Smith found in the localities named below the following amounts of carbonic dioxide :—

	Mean of several Analyses.
Different localities in Scotland at variable heights above the sea	·0336
Open spaces in London	·0301
Streets in London	·0341
Perth and its vicinity	·0414
Neighbourhood of narrow streets in Glasgow	·0539
Neighbourhood of wide streets in Glasgow	·0461
Outskirts of Manchester	·0369
Streets of Manchester	·0403
On the Lake of Geneva (according to Saussure)	·0439

The amount of aqueous vapour in the air varies with the temperature. Its usual amount varies from 50 to 75 per cent. of the amount required for saturation of the air.

According to the researches of the celebrated bacteriologist, Miquel, at Paris, the number of microbes is least in pure external air. The atmosphere of a vinery contains at least twenty times more bacteria than country air. The number in close places is considerably greater than in the external air, and the number increases in proportion as the locality is populated and the ventilation defective. In inhabited houses the impurity of the air is especially due to the products of respiration, carbonic acid, and alkaloids the composition of which is not completely known.

The air also always contains a quantity of fine dust, and conveys the microbes which

originate organic decompositions, and in some cases specific febrile diseases. In inhabitated parts the air contains in addition particles of carbon, of hairs, fibres of tissues, particles of starch, of epithelium, etc. A large proportion of these constituents renders air impure; but the pollution of air is due chiefly to the products of respiration—carbonic dioxide, and alkaloids not yet completely recognised.

In respiration a quantity of oxygen is consumed, and the expired air contains 4 per cent. of carbonic dioxide.

At each inspiration, an average adult inhales about 500 cubic centimetres of air; which, reckoning 16 or 17 respirations per minute, is equivalent to 500,000 cubic centimetres per hour. This air when expired contains 4 per cent. of carbonic dioxide, or 20,000 cubic centimetres (20 litres). It follows that the air of rooms, even when very well ventilated, cannot be as pure as external air. According to Pasteur, the air of a room cannot be regarded as pure when the carbonic dioxide in it exceeds ·06 per cent. In Germany, Pettenkofer has fixed the maximum as ·07 per cent. If one accepts the first of these standards, it follows that 100 cubic metres of fresh air are required per hour for each person; or, according to the German standard, 67 cubic metres of air.

Owing to the known toxic effects of carbonic dioxide, it has been commonly assumed that the deleterious effects of air in confined spaces depend on the amount of this gas present.

The carbonic dioxide does not, however, play so important a rôle as the organic impurities which are also expired.

Among the many researches on this point may be mentioned those of Professor William Hammond, of the United States. He confined rats under bell-jars; the carbonic dioxide formed was removed, while the oxygen consumed was carefully replaced. The rats, notwithstanding these precautions, died in about an hour in all the experiments.

The more accurate examination of the noxious principles in expired air has been attempted by many *savants*, among whom may be mentioned Brown Séquard, Arsonval, and Wurtz, who gave an account of their researches at the Académie des Sciences in January, 1888. They give the following reason for thinking that the toxic matter in expired air is alkaloidal: (*a*) the aqueous vapour expired when condensed gives an alkaline reaction; (*b*) the toxicity is not destroyed by heating in a closed retort.

If the products of respiration are condensed and injected into rabbits in doses of 4 to 8 grammes, the following symptoms are produced: (1) Dilatation of the pupils; (2) diminution of the frequency of respiration; (3) slight paralysis, especially of the hinder extremities; (4) a rapid fall of the bodily temperature of from 0·5° to 5° Centigrade.

With larger doses of 20 to 25 grammes, the symptoms are similar, but more pronounced; but shivering and convulsions also occur, and the animals have a choleraic diarrhœa which lasts until a fatal result supervenes, which is generally in about 3 or 4 days after the injection.

The symptoms are the same whether the injection is made into an artery, a vein, or under the skin.

Carbonic acid is evolved in amount proportionate to the quantity of organic matters evolved, consequently it is in ordinary cases a fairly accurate index of the purity of the air in a room.

The evil effects of breathing impure air are not immediately manifest, owing to the natural ventilation which normally arises from the difference of temperature between the outer and inner air. This ventilation is however insufficient, and evil effects soon appear, as shown by the pale and wretched complexion of children obliged to be kept indoors during cold weather.

The organic exhalations of the skin contribute with other matters to pollute the air of houses.

Polluted and confined air aids the preservation of pathogenic microbes, and we find, therefore, that contagious diseases are propagated easily and with intensity in badly ventilated rooms. The most striking proofs of this have been furnished in the case of phthisis. The Army Sanitary Commission in England (Report 1858) found that in

barracks where each man had 300 cubic feet of space, the mortality from phthisis was as high as 13·8 per 1,000 men ; while in barracks where the space was 560 cubic feet per man, and the ventilation was improved, the mortality from this cause did not exceed 7·3 per 1,000, the circumstances as to climate, situation, etc., being identical in the two cases.

The great frequency of this disease in special industries in different countries confirms the same view of its origin. Pure air is the most effective curative agent against phthisis and other microbic diseases. Doctors Stokes and Blake were cured of phthisis by living and sleeping in the open air for several years, and the same treatment is now recognised as being of the greatest value in phthisis.

Methods of Ventilation.—No nation has appreciated so thoroughly as the English the importance of fresh air. It is one of the causes which have made the rate of mortality lower in Great Britain than in most continental countries.

The English have in large measure ceased to fear the phantom of chill ; their experience having shown that illness is seldom caused by currents of air or variations of temperature, and that the free entry of fresh air is the best guarantee against illness. Both in winter and summer the more intelligent English have their bedroom window open from morning to night, often also during the night. The bed clothes are exposed to the air during the day.

In summer windows and doors are always open ; in winter a fire burns

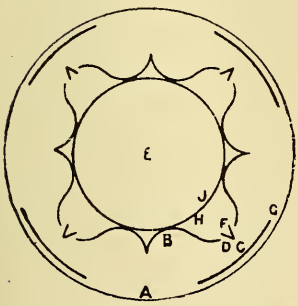


FIG. 24.

FIG. 25.

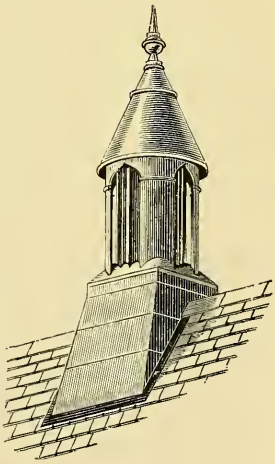


FIG. 26.

AIR-PUMP VENTILATOR.

Fig. 24 is a horizontal section of the ventilator. Its external form is shown in Fig. 25, and in Fig. 26 it is seen placed on the roof of the building and connected with the interior by a shaft.

A. Opening for entry of air. **B.** Curved plates separated by **F.** **C.** Narrow circular passage. **D.** Passage divided into two by **F.** **E.** Central tube. **F.** Partition in middle of passage **D.** **G.** Curved plate to confine the passage of air. **H.** Chamber receiving and preventing the air from entering the central tube. **I.** Plate of sheet-iron separating **H** from **E.**

in the open fireplace, and windows are commonly opened when the room is vacated.

The ventilation of churches, theatres, schools, etc., is not so effective as is desirable. Usually natural means of ventilation are relied upon, and each room is independently ventilated. Speaking generally complicated systems of ventilation are not in use; dependence being placed upon the natural interchange of air produced by differences of temperature. This interchange is accelerated by means of exhaust shafts, such as Boyle's, shown in Figs. 24–26.

In Boyle's apparatus, the air enters at **A**, follows the curves of **B**, reaches the passage **C** with an accelerated velocity, crosses **D**, and causes by this means an up-current in the tube **E**. This ventilation is employed in the hospital-ship *Castalia* (p.158). It is often placed also at the upper end of ventilating shafts for drains. The whole subject of such exhaust-ventilators must be regarded as still *sub judice*. The results obtained in a series of experiments made at Kew by a Committee of the Sanitary Institute seem to indicate that the up-current of air in a vertical pipe is not increased by a cowl at its top. It is obvious that such a pipe, with its upper end open, will not in any case act as an exit-ventilator unless at some other point (of the drain or room, as the case may be), air is freely admitted, so as to admit of the required circulation of air.

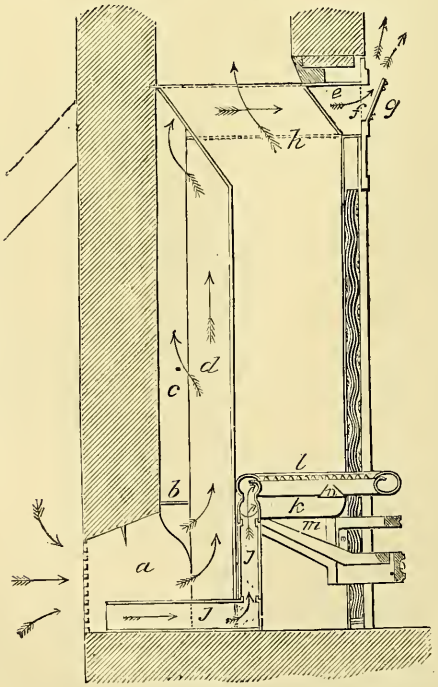


FIG. 27.—SECTION OF VENTILATING STOVE.

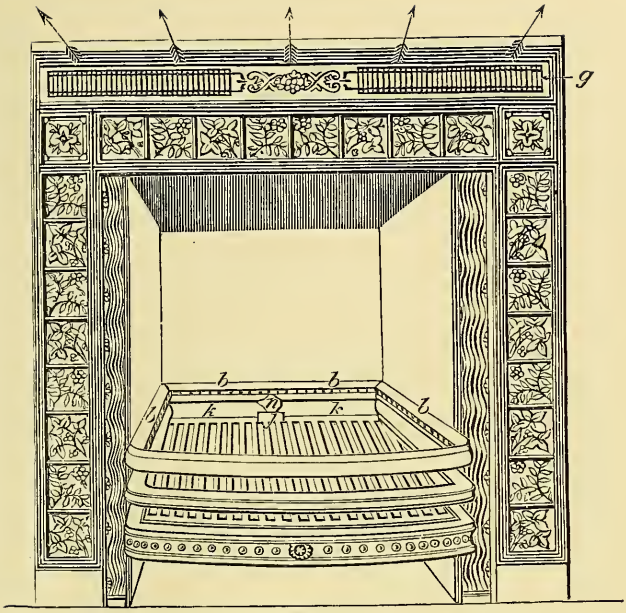


FIG. 28.—FRONT VIEW OF THE SAME STOVE.

a. Opening in external wall to admit fresh air. *b*. Plates obliging the air to impinge on the projections *d*. *c*. Chamber for cold air. *d*. Iron projections to increase the heating surface. *e*. Upper end of the chamber *c*. *f*. Opening into room for warmed air, furnished with a filter and a movable cover. *g*. Flap directing the air upwards. *h*. Chimney opening. *j*. Canal for entry of air into the fireplace. *k*. Pipe for conveying the air towards the front of the fireplace. *l*. Hollow frame with small conical holes for distributing air and rendering combustion more active. *m*. Inclined iron grating. *n*. Junction of the pipes *k* with the frame *l*.

Open fireplaces, with fires in them, whether in private houses or public buildings form efficient means of removing foul air, and causing the entry of a corresponding amount of fresh air. The construction of fireplaces and chimneys has been greatly improved. Douglas Galton's stove has been already described (p. 62). The same principle is embodied in Boyle & Son's stove, shown in Figs. 27 and 28. The construction of this stove admits of complete combustion of the fuel, and consequent augmentation of heat; while fresh air is warmed and admitted into the room above the fireplace.

In England it is an accepted principle that the openings for entrance and for exit of air must be proportionate in size, in order to avoid disagreeable draughts.

Among other simple ventilating arrangements may be mentioned the following:—

1. The upper panes of a window are made movable, working on hinges; thus the entering air by the inclination of the panes is directed

upwards and mixes with the hot air above before spreading over the room. The *Sheringham valve* is a modification of this principle applied to walls.

2. The upper pane is made movable about a central axis. Thus, with the window obliquely open, there are two ventilating openings, the lower acting for the exit of foul air, the upper for the admission of fresh air.

3. In Moore's system, the window is divided into a number of plates all movable about a central axis, and placed over one another. This form of ventilator keeps out rain more efficiently than the two preceding ones.

It is not usual in England to have a large number of plants in living-rooms. The humidity of the plants has been shown to be a convenient soil for the development of pathogenic microbes. Professors Pippingsköld and Salzman of Finland have proved the acquirement of malarial infection from flower-pots filled with earth taken from a malarious soil ; the disease disappearing when the pots were emptied. Emmerich has proved (*Archiv für Hygiène*, 1884) the presence of pneumococcus in the floor of a prison while an epidemic of pneumonia prevailed, which would make one believe that they may similarly exist in flower-pots.

4. *Cooper's circular glass ventilator* consists of a circular disc of glass, with five oval apertures in it, working on a pivot through its centre, attached to the window, which has five similar holes pierced in it. The two sets of openings can be made to correspond or not, thus opening or closing the apertures.

5. *Sheringham's ventilator* consists of a rectangular box placed in the wall about 1 foot below the ceiling. Outside, this box is covered with a grating to prevent the entry of birds. Inside, it is closed by a metallic plate movable about a hinge at its lower end, and worked by a cord. The plate is ordinarily kept so that the entering air is directed upwards towards the ceiling.

6. *Ellison's conical bricks* are placed in external walls, with the wider end towards the interior of the room, thus ensuring dispersion and diminished rapidity of the current of entering air.

8. In single-roomed buildings and in corridors an efficient ventilation may often be secured by means of openings running from one external wall to another near the ceiling, and communicating with the external air by air-bricks. These tubes are of zinc, perforated with numerous openings, a vertical diaphragm dividing them into two. According to the direction of the wind one-half serves for the entrance of fresh air and one for the exit of vitiated air.

9. The system of Mr. Potts is founded on the same principle as the last. It consists of a hollow metallic cornice around the room separated throughout its length into two canals by means of a horizontal plate of sheet-iron. Pure air enters by external orifices into the lower canal and finds its way into the room by numerous perforations in the cornice. The upper canal opens either into the chimney or into a special pipe, and serves for the discharge of the foul air which enters the cornice by a large number of minute openings in it.

This system of ventilation is recommended for schools, which, at the

time of their erection, have not been provided with the proper means of ventilation.

A modification of this system consists in having two ordinary perforated pipes; one for the entry of pure air running along the cornice of three sides of the room; the other occupying the fourth side, and serving for the discharge of vitiated air into the chimney.

10. Tobin's ventilators are also in use. They consist ordinarily of iron or wooden tubes. The air enters by external openings at the flow-level, and is carried 6½ feet high by these vertical tubes. A valve is generally provided to regulate the amount of air entering.

Boyle's modification of Tobin's tube is shown in figures 29 and 30.

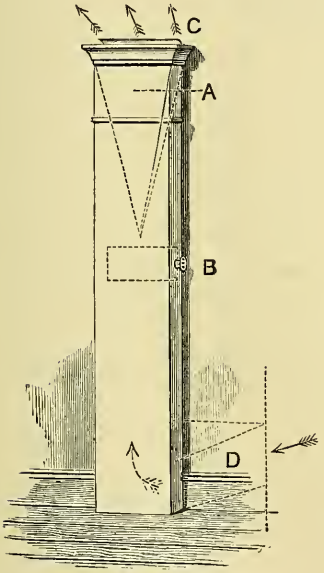


Fig. 29 A.

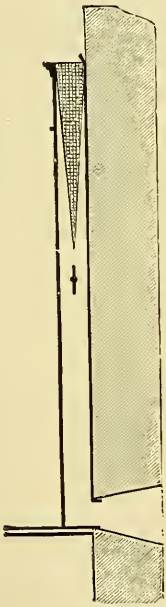


Fig. 29 B.

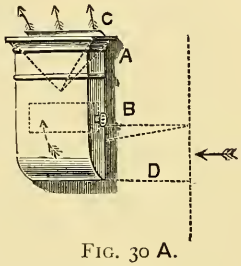


Fig. 30 A.

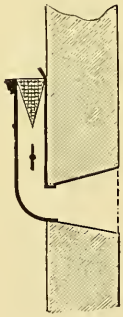


Fig. 30 B.

Tobin's Tubes with Modifications.

A. Filter for the air. **B.** Valve for shutting off the air. **C.** Valve directing the air, so that it cannot strike against curtains, etc. **D.** Point of entry of air from outside.

Fig. 29 **B.**—Section of the same ventilator.

Fig. 30 **A.**—Same system, only the tube is shorter and placed higher in the wall.

Fig. 30 **B.**—Section of the same.

11. McKinnel's ventilator for upper storeys or houses of only one storey, consists of two tubes placed one within another; the internal tube is so much smaller than the external as to allow of a space between the two equal to the section of the internal tube. This tube is longer than the other, and extends further out. It serves for the escape of foul air. At its margin it has a horizontal projection outwards, so that the fresh

air entering between the two tubes does not at once fall vertically, but is driven parallel to the ceiling.

12. Another system consists in having a double ceiling, the lower of zinc or papier mâché pierced with a considerable number of small holes. The interval between the two ceilings constitutes an air-chamber communicating at its sides with the external air.

The ventilation of ships and of carriages has been effected by means equally simple.

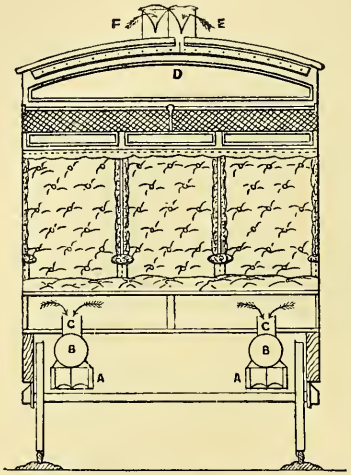


FIG. 31.—VENTILATION OF CARRIAGE BY MEANS OF AIR-PUMP VENTILATOR (VERTICAL CROSS SECTION).

The use of Boyle's air-pump ventilator for railway carriages is seen in Figures 31 and 32.

The air-pump ventilators **A A** have a diameter of 14 inches, they communicate with the tubes **B B**, 8 inches in diameter, placed under the carriage throughout its length and communicating with each compartment by the branch tubes **C**.

The branches nearest **A** have a diameter of 4 inches; the most remote of 5 inches. The tubes **C** open 4 inches above the floor, under the seats within the carriages. The openings are closed by a not very thick cloth arranged so as to prevent dust from entering the tubes. When the train is moving the air-pump ventilators aspirate the air from the compartments, which are thus purified.

Fresh air enters the top of the carriage by the tubes **D** 3 inches in diameter, which are placed under the ceiling throughout its length. These tubes **D** are perforated and joined to the ventilators **E** placed on the roof. The latter are protected with gauze to obviate the entry of dust.

This system does not cause draughts and ventilates continuously.

In the description of public buildings, some systems of general ventilation will be mentioned.

While attempting to keep the air within houses as pure as possible, everything practicable must be done that the external air shall not be

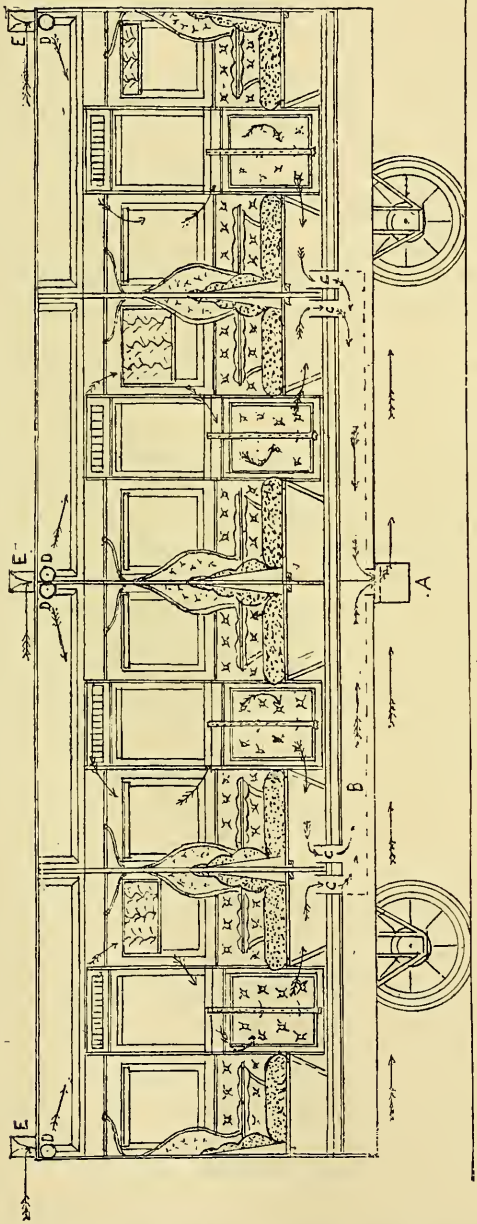


FIG. 32.—VENTILATION OF RAILWAY CARRIAGES BY THE AIR-PUMP VENTILATOR (LONGITUDINAL SECTION).

vitiated. The old narrow streets are being pulled down and rebuilt in an enlarged and wider form.

Enormous sums have been spent on the creation of vast parks. London possesses a very large number of parks, some very extensive. *Regents' Park*, in the north-west district, occupies an area of 472 acres. To the south-west we find *Kensington Gardens* (310 acres) and *Hyde Park* (390 acres), which form a continuous open space. To the east of these are *Green Park* (60 acres) and *St. James's Park* (93 acres).

In the north of London are *Primrose Hill* (50 acres), near Regent's Park, and *Finsbury Park*, and in the north-east *Victoria Park* (300 acres). These are situated in thickly populated districts, offering pleasant shade and recreation grounds.

To the south of the Thames are Battersea Park (250 acres), Southwark Park, Kennington Park, and Greenwich Park. In the suburbs of London are found Woolwich Common, Abbey Wood, Castle Wood, Oxleas Wood, Wimbledon Common, Wandsworth Common, Clapham Common, Crystal Palace Park, etc.

Within the last year or two additional open spaces have been acquired by the London County Council in Vauxhall, Brixton, Herne Hill, Highgate, and Stoke Newington.

In addition there are in London a large number of open squares and crescents, which are usually closed except to the neighbouring inhabitants. They are generally planted with trees and grass.

Résumé of the Hygiene of Water.—Pure and abundant water has always been considered an essential condition of health. The definition of what constitutes pure water has not yet however been satisfactorily settled. Natural instinct tells us that a good water should be limpid, fresh, inodorous, colourless, and without smell. These are the indispensable qualities for water intended for food and for domestic purposes.

To test the limpidity of water, it is put into a transparent glass tube, shaken and placed against a dark surface with the light shining on the water from the side. If it is not limpid, the solid particles in suspension are easily detected. Small bubbles of air must not be confused with solid particles.

To test the absence of colour in a water, it is placed in a long glass cylinder of perfectly colourless glass, the cylinder being laid on a white surface. A check experiment is made by filling a similar cylinder with distilled water. The degree of colouration is seen by comparing the two when seen from above. Natural water is never so colourless as distilled water, but if it is markedly coloured, and especially if yellow, the water is probably unfit for drinking.

To detect odour, a wide-mouthed flask is filled one-third full and shaken; if any disagreeable smell is evolved, the water should not be drunk. Warming the water helps to render manifest any doubtful smell. Water having a disagreeable smell should not be drunk.

These simple physical tests, which can be applied by all, and the more accurate results of chemical analysis and microscopic examination have been long regarded as sufficient to determine the quality of water.

The important discoveries of Pasteur, relative to bacteria as causes of disease, have somewhat modified this opinion.

Water which is the clearest and pleasant to drink, and chemically the purest, may possibly be injurious if pathogenic microbes have polluted it. It is none the less true, however, that bacteria are much more abundantly found in impure than in pure water. The contagia of the specific infectious diseases in most cases are apparently only reproduced in the human organism, with the exception of such diseases as malaria and perhaps cholera in India. It is evident, therefore, that the possibilities of pollution of water are greatest in the neighbourhoods in which men dwell. The pathogenic materials pass directly from patients into water or the earth, either in a dry state through the atmosphere, or through water used for washing, or through excremental matter or otherwise. It is probable that several forms of pathogenic bacteria after entering the soil multiply there and complete the cycle of their existence. Rain washes them away, and carries them into wells or other sources of drinking-water.

In epidemic periods, there is always reason to fear that the water of wells in an infected locality, even though apparently good, is really specifically polluted. One can only depend on such water being free from pollution when it has been filtered through thick beds of the earth, and when it can be absolutely guaranteed against the entrance of surface-water.

Water thus polluted is dangerous not only for drinking, but also for other domestic purposes, if it is not boiled. Pure water is essential for use in all domestic concerns.

The presence of pathogenic bacteria in water has been attempted to be demonstrated by the microscope and by culture experiments. The means of distinguishing between pathogenic and non-pathogenic organisms by this means are however imperfect, and there is no certain relationship between the number of colonies in plate-cultivations and the degree of impurity of a water.

Experiments made by M. Miquel in Paris, M. Uffelmann at Rostack, and Professor Percy Frankland in England, appear to indicate that negative results by such methods do not offer certain indications.

Pathogenic organisms, so far as they have been recognised, do not live a long time in water. It must be remembered, in estimating the value of negative results, that only a small quantity of water can be examined bacteriologically at a time. Also that bacteria multiply much more rapidly when water is kept calm. Thus the water of a comparatively pure well, only seldom used, may contain a larger number of bacteria than that of a less pure well in which the water is being constantly used. The bacteria may multiply greatly in a sample of water for analysis, if it is not examined at once, especially if the water is kept at a higher temperature than ordinary. Quietude and a temperature of 15° to 40° C. are the factors most favourable to the development of micro-organisms, a low temperature and movement being on the contrary unfavourable. The presence of free carbonic acid in the water hinders the development of micro-organisms.

Nevertheless, in the present state of science, we can say that the fewer bacteria a water contains, the more it can be guaranteed from power to produce infection.

Filtration has been attempted to secure freedom from infection. Filtration on a small scale succeeds with difficulty. Filters of gypsum completely retain micro-organisms, next in decreasing order come filters of polished earthenware (Chamberland's filter), and asbestos filters. In nature, water is filtered by passing through thick strata of the earth. The lower the depth from which water is filtered the more certain is it to be pure. Water obtained from a great depth contains no bacteria. The denser the strata through which water is filtered, the more effectually are bacteria intercepted.

Water taken from the surface should not be used without filtration in inhabited districts, as it washes various impurities out of the air.

The filtering beds used for filtering the water of towns on a large scale contribute in an effective manner to its purification. The question may be asked whether the pathogenic micro-organisms which have a short life-time in water, can retain their vitality and be carried in the water supplied through filtering beds and well-constructed conduits? The answer is not certain, as the spores of bacteria have shown a vitality greater than that of the bacteria themselves. Thus the spores of the bacillus of enteric fever can retain their power of multiplying for three weeks in water. The spores of the bacillus anthracis under the same conditions preserve their vitality for a year. Wolffhügel and Riedel have established the existence of the cholera bacillus with the bacteria of water for a period of fifteen days, and Hueppe for five to ten days; but in these cases the water was at a temperature of 18° to 22° C.

Water taken from the surface can never therefore be guaranteed against infection, although filtered to the same degree as a subterranean water which has traversed deep strata of the earth.

It is very important that there should be no stagnation in water conduits. Stagnant water in reservoirs is always a source of possible danger.

It will be seen from the preceding summary how necessary it is to take precautions to preserve drinking water from contamination, the most important precautions being taken to prevent it from containing any organic products of human excretion.

Where, as in the case of soft waters, there is danger of lead poisoning, lead pipes should not be used, or the water should be deprived of its solvent action on lead by filtering through lime-stone.

Arrangements as to Water Supply.—The Thames on its way through London receives two important affluents, the Lea to the north, and the Ravensbourne to the south. The water of these three rivers is extremely muddy; but they contain many other things besides mud.

Up to 1864, the sewage of London was emptied directly into the Thames, its water being simply diluted sewage. A different result was however looked for when the great collecting sewers were brought into use in that year, carrying the sewage 13½ miles toward the sea, where it is

emptied beyond London into the Thames. This however did not benefit the Thames opposite the metropolis so much as had been expected, for two reasons.

In the first place, the numerous manufactories in London continued to throw a large share of their waste products into the river. At low water, at the openings of these sewers from manufactories, a bed of black sludge is found of a thickness of about 18 to 20 inches.

The second cause of the filthiness of the Thames is the fact that sewage matter is carried upwards beyond the outflow by the movements of the tide.

By the Rivers Pollution Act, 1876, the municipal authorities of London have been obliged to attempt to remedy this state of things. Since 1888, an attempt has been made to purify the sewage by means of lime and later by manganate of soda, the deposited sludge being carried out to sea in barges. The process has proved expensive, and not satisfactory from a sanitary standpoint.

Attempts have been made to solve the difficulty in other directions. It is probable that London will eventually adopt the system of irrigation which has been successful in many towns in England, as well as in Paris and Berlin.

It cannot be said however that the state of the Thames and its affluents has exerted any direct and markedly deleterious effect on the population of London, proving the power of running water to destroy poisonous matters.

Certain districts, notably Hampstead and Highgate to the north, and Deptford and Shooter's Hill to the south, have vast subterranean streams of water of good quality, which form springs at certain points. This water is made use of where abundant.

There are in several parts of London deep wells. The *Kent Water-works Company*, supplying a part of London, delivers daily to about 75,000 houses more than 13 million gallons of subterranean water, which is so pure as not to require filtration. The wells are in south-east London on the two sides of the Ravensbourne. The good quality of this water is explained by the thick bed of clay which extends under not only the whole of London, but stretches also under the valley of the Thames for a length of 125 miles and a variable width from Reading on the west to Harwich on the north, and Herne Bay on the south of the mouth of the Thames.

The *New River Company* takes a large portion of its water from wells in the chalk as well as from the river Lea. This Company is the oldest in London, having been founded in 1619. Up to 1739 the Company was only supplied by spring-water ; but the increased consumption necessitated the use of the water of the Lea. Formerly the water came from the springs of Chadwell and Amwell, situated 15 miles from London. The Company now however obtains water not only from the Lea, but also from several wells in the valley of the Lea, and also from springs at Hampstead and Highgate. The water from these wells and springs is so pure as not to require filtration ; that of the Lea is filtered.

The New River Company delivers on the average a daily amount of $33\frac{1}{2}$ million gallons for 154,000 houses.

The five following Water Companies draw their water from the Thames; the *Chelsea Waterworks Company* (founded in 1723, and supplying daily $9\frac{1}{2}$ million gallons for 36,000 houses), the *Lambeth Waterworks Company* (founded in 1875, and supplying $19\frac{1}{2}$ million gallons for 92,000 houses), the *Grand Junction Company* (founded in 1798, and supplying 18 million gallons for 57,000 houses), the *West Middlesex Company* (founded in 1806, and supplying 16 million gallons for 74,000 houses), and the *Southwark and Vauxhall Waterworks Company* (founded in 1845, and supplying over 26 million gallons for 113,000 houses).

The Chelsea and Lambeth Companies draw their water from the south side of the Thames near Molesey; the three other Companies on the north side, some miles higher, near Hampton. The intakes for water are from $1\frac{1}{4}$ to $3\frac{3}{4}$ miles above Teddington Lock where the tide ceases to be felt.

The eighth Water Company is the *East London Waterworks*. This is the most important, as it supplies daily to 170,000 houses $46\frac{1}{4}$ million gallons of water. It derives its water chiefly from the Lea, but has a second supply from the Thames at Sunbury, $1\frac{1}{4}$ miles above Hampton.

For the purification of river-water, two systems of filtration are used, one natural, the other artificial.

Natural filtration is effected by digging large reservoirs parallel with the banks of the river. The water flows into these reservoirs from the river, or the ground water on its way into the bed of the river, being filtered through the ground in transit. The filtering reservoirs are very large, those of the East London Waterworks extending to 222 acres.

From these reservoirs, the water, is drawn by means of pumps, on to artificial filtering beds. The filtering beds consist of layers of sand, gravel and stones. The stones are lowest, then a layer of smaller stones, a layer of coarse gravel, of finer gravel, and finally a layer of sand. The rapidity of filtration varies in different Companies from 13 to 24 gallons per hour for each square foot.

The Water Companies of London deliver altogether each day 182 million gallons to 769,093 houses, some of them outside London itself. The majority of houses are supplied with water in the house, but in some it is only supplied to the yard.

The eight Water Companies are private Companies. They are under the supervision of the Local Government Board, which has for this purpose a special department directed by an engineer called the water examiner and a water analyst. The regulations for the carrying on of these Companies are contained in the Metropolis Management Acts of 1852–71.

The Companies are required to take their water from the river above the tidal part, to filter it effectually, and to carry out certain regulations as to water-pipes, etc.

They are required to instal a water supply in every house within their area of distribution when required by the Local Authority, the cost falling upon the owners of houses.

The water-rate is calculated in proportion to the rental of the house. In certain cases the use of water-meters furnished by the Companies is allowed at a special rental.

Résumé of the Hygiene of Food.—The great difference in the food of various persons shows that the digestive organs in man are capable or adjusting themselves to circumstances, and of obtaining from very diverse foods the materials which form the source of potential energy. It is however clear that a mixed diet of animal and vegetable food best satisfies our requirements, and is most suitable for our digestive apparatus. In the sanitary legislation of all countries regard has been had to the influence exerted by the quality of foods on personal health. Science however has not yet been able to fix with exactitude the injurious influence caused by foods of indifferent quality. It is certain that micro-organisms play an important part in this action. As micro-organisms enter from without, it follows that a food, while presenting a normal appearance, may be the vehicle of disease. This has been established with certainty for milk. There have been sufficient proofs of the production of scarlet fever by milk which had been stored in the sick-room of a scarlet fever patient or handled by a person who had charge of such patient. The same remark applies to the origin of enteric fever or cholera from milk placed in a vessel which had been mixed with specifically contaminated water or which had been washed with such water.

By experiments on animals, it has been shown that tuberculosis, a common disease among cattle, can be propagated by milk. This gives strong grounds for believing that the consumption of uncooked milk, the remains of a savage custom, is one of the causes of the propagation of this formidable disease. The bacteria are destroyed by cooking, so that we have a simple means, which ought never to be neglected, of protecting ourselves against the dangers from this source.

Summer diarrhœa and its more intensified form known as infantile cholera, seems to have been shown by the researches of Professor Vaughan of Michigan, to be due to a ptomaine, called by him *tyrotoxicon*, which is formed in milk by a specific micro-organism not yet discovered. Vaughan believes that tyrotoxicon can also be formed in the stomach, if its functions are deranged or if it contains a large quantity of milk, as may easily happen in the hot season when infants are distressed by thirst. This would explain the exceptional cases in which infants fed from the breast are affected by infantile cholera. Vaughan has demonstrated the existence of tyrotoxicon in ice-cream, cheese, and decomposed oysters. This poison is happily destroyed by cooking. The investigations of Vaughan render it very probable that the serious intestinal affections so common in the hot season, are produced by the toxic products of bacteria in foods taken in an uncooked or cold condition.

If pathogenic matters can be propagated by foods apparently sound, it is obviously important to forbid the sale of foods from a contaminated locality. The danger is greatest with impure foods or foods in an incipient stage of putrefaction. Even though cooking destroys the toxicity of such foods, water and utensils may become contaminated, and this possibility justifies their condemnation.

Adulteration of foods is of such importance as to require a very severe control on the part of the public authorities. Large manufactories are employed solely in making the materials for adulteration, which are sold publicly.

A large portion of these materials, as for instance the colouring materials of cheese and butter, are so much in vogue in commerce that they are perhaps necessary from a commercial standpoint; and they are at any rate not added to deceive the purchaser. The sale of compound substances as simple substances is however forbidden by the Sale of Food and Drugs Act 1875–79, provision being made for a label on each packet clearly indicating its character.

A large number of disturbances of the human economy are doubtless caused by adulterated foods, though often it is difficult to show a direct relation between the two. It is only when the same disorders affect several persons living under the same conditions that the doctor can discover the cause of what is often hid under the general name of dyspepsia.

Most civilized natives have regarded the question of adulteration as most important and have made laws concerning it. But in this case, as in others, laws do not suffice; the laws must be known by all, and official measures must be taken to secure their execution.

With a view to hinder the exportation of adulterated foods, the question of an international law against adulteration has been raised. This subject was discussed, on the initiation of Professor Brouardel in the International Congress of Hygiene at Geneva in 1882, at the Hague in 1884, and at Vienna in 1887. A large number of facts relative to the legislation in different countries were brought out, and resolutions were passed, but hitherto without any effective result.

The most practical measure is to make the vendor responsible for the articles he sells, leaving him to negotiate with the manufacturer if the latter has supplied him with adulterated articles. In the English law, the vendor is protected if he produces a written warranty from the wholesale agent or manufacturer, but legal proceedings may then be taken by the Local Authority against the latter.

Sanitary Provisions as to Foods.—The Sale of Food and Drugs Act applies to London, the Medical Officers of Health and Inspectors of Nuisances having the supervision of the inspection of foods.

To supply a population of 5 millions with a sufficient quantity of food, to see that this food is good in quality and not adulterated, and that no nuisance arises in connection with the supply of this food, is a problem the solution of which presents great difficulties.

Sale of Foods.—In London the wholesale sale of meat has its chief seat in the city. The Corporation of the city of London has constructed at Smithfield large markets remarkable for their fine architecture of the Renaissance style, and for their admirable arrangements for cleanliness and ventilation. They consist of three large buildings arranged in order one after the other.

The largest, called the *Central Meat Market* occupies a space of $3\frac{1}{2}$ acres. It is 210 yards long by 81 yards wide and 10 yards high. Throughout its length it has a central avenue 9 yards wide, and it is crossed in the centre by a carriage-way 17 yards wide. On the two sides and parallel with this road, are three passages 6 yards wide. The market is thus divided into 16 parts, each containing stalls for the butchers, places for adminstration, refreshment stalls, lifts, lavatories, water-closets and urinals.

Each butcher's stall contains the shop, and a back-shop composed of two parts, one leading to the upper storey. The latter serves for a counting house, while the former is used for preserving unsold meat. Each stall occupies 430 square feet.

The shops have no partitions, but pillars furnished with cross-bars of iron from which the meat is hung. The back-shops have perforated wooden partitions, and during the night are secured by iron gates. The upper stories are partitioned by boards. Each stall has its water-closet.

There are four refreshment stalls at the outer corners of the market. The floor of the market is inlaid with asphalted joints, and resting on a bed of concrete. During the day it is covered with a thick layer of sawdust. A large number of water-taps are provided for washing and cleansing.

The Authorities undertake the cleansing of the passages and of the places around the market. The occupiers are required to keep their own stalls clean.

The ventilation, depends upon the natural circulation of air. All the gates, which during the day are open, are perforated, so as to allow of free ventilation even during the night. The upper part of the windows is always open and furnished with louvres ensuring continuous ventilation. The central way and cross-passages have a roof at a higher level than the principal roof. These roofs rest on walls of ground glass with iron frames, which can be opened or shut at will.

Above each of the four corners of the market is a tower 90 feet high, containing exhaust pipes for vitiated air.

The hall is built on arches constructed with bolts and fillets of iron. Above this arch is a large goods platform of the Great Western Railway. In the vicinity there is a station of the Metropolitan Railway, communicating with the Great Western Railway.

Separated by a street from the preceding meat market, is a second *central market for pork, and poultry, and provisions.* It is built like the preceding, but is smaller and more nearly square, being 86 by 82 yards. The shops are arranged along the external walls, and partly in the middle; each shop has a back shop attached. The floor is of brick, set in cement. The ventilation and cleansing are arranged as in the Central Meat Market.

To the west of the preceding market is *the Central Fish Market*, which does not contain so many stalls. In its middle is a part a little elevated, where are found the vendors with their fish, lobsters, oysters, etc. When the chief business is over, the remaining fish, etc., is sold by auction to small purchasers.

In this same market are sold legumes and other products, the stalls for which are ranged along the walls.

The ground is paved with flag-stones set in cement.

Under the markets are cellars and refrigerating chambers. Each stall has its steps leading down to the cellar, which is lit by thick glass in the pavement. The cellars in the fish-market open on to the street.

To the south of the fish-market and the poultry-market is a triangular place, in the midst of which is a building with a high chimney. By its means the vitiated air of the cellars is extracted, the different flues from these cellars communicating with the central chimney. In the same building are the stoker's department, coal-cellars, water-closets, and public urinals.

The *Markets Committee*, appointed by the City Corporation, has charge of the administration of the markets, and appoints their officers.

Although only meat, fat, game, poultry, fish, cheese, butter and vegetables are sold here, other articles of food are brought by the underground platform, as corn, flour, etc.

Immense underground store-houses receive these merchandises. To ensure regularity of transport the administration undertakes the supply of horses and waggons.

The markets are open every week-day: from 4 a.m. to 2 p.m. Tuesday and Wednesday, to 3 p.m. on Thursday, to 4 p.m. on Monday, to 5 p.m. on Friday, and to 8 p.m. on Saturday.

Each place occupied by merchants must be cleansed daily, any nuisance being punishable by fines.

The fish-market at Smithfield, described above, is not the principal fish-market for London. This is at *Billingsgate*, on the banks of the Thames, near London Bridge, between Lower Thames Street and the river.

In the reign of Elizabeth all kinds of foods were sold here; but since the time of George III. the market has been restricted to the sale of fish. The present market was completed in 1877, after the designs of Horace Jones, the same architect who designed the Smithfield Market.

It is built of stone, with a glass roof. Its paving is of cement. In the interior it has no stalls; the interior is cleansed daily. For this purpose there is a large number of taps and of gutters for draining off the water. The sale commences at 5 a.m. The fish is brought in large hampers and placed on the quay outside the market; and the wholesale market is held here. The fish is then brought into the market for retail sale to fishmongers. Salmon and crustacea are sold by weight, other fish by number.

An enormous quantity of fish is brought to Billingsgate by sea and by railway. It is brought to the market in waggons from railway stations.

The other important markets in London are: *Leadenhall Market*, near Leadenhall Street, for poultry and game; *Covent Garden Market*, for vegetables, fruits, and living plants (some of the rarest coming from all countries of the world); the *Great Eastern Railway Market*, for fish and vegetables; *Shadwell Market*, at the east of the London Docks; *Elephant and Castle Market*, at Newington; *Columbia Market*, at Bethnal Green, etc.

The trade in these markets is essentially wholesale, retail purchases being made in the shops found in the principal streets throughout London. These shops are, as a rule, remarkably well kept. The butcher's shop is often of white marble; the block for cutting meat, of hard wood. The ground is in mosaic or cement, with a layer of sawdust. The walls are of polished tiles or some similar material. The whole shop is washed down daily.

The control exercised by inspectors over the quality of meat is very severe.

There is no special inspector in the meat-markets for trichinæ in pork in any part of Great Britain; but any suspected meat may be submitted to microscopic examination by the Medical Officer of Health. The English

only eat pork when well cooked; even smoked bacon is boiled before being eaten. No cases of trichinosis appear to have been observed except from American pork.

The Milk Trade.—As already seen (p. 39), the regulations as to the sale of milk contained in the Dairies', Cowsheds', and Milkshops' Order of 1878–86 are very severe. In London these regulations have secured for the population a good and pure milk supply. Since it has been proved that epidemic diseases have been propagated by milk, the control of the milk supply has been carefully supervised. Large dairy companies have been formed, whose supply of milk is based on most minute and rigorous regulations. By their contracts these companies have the right to inspect the farms and cowsheds before accepting the milk of any farmer, and can order any necessary measures to be taken. The state of health of any cow can be examined by a veterinary surgeon, and the milk from any animal rejected. He can give instructions as to fodder, the maintenance of cleanliness, and the treatment and cooling of the milk.

To prevent the spread of infectious diseases by milk, the farmer is required in these contracts to call in a doctor, if any person employed in the dairy falls ill. If the disease is infectious, the secretary of the Company must be at once informed, who will indicate the measures to be taken. In the event of serious disease, the delivery of milk from the farm is forbidden, but the farmer is paid as if he delivered it. The Company send inspectors to see that the necessary measures are taken. Arrangements may be made with the local Medical Officer of Health to obtain information as to each case of infectious disease arising in the neighbourhood of a cowshed or dairy.

Twice a day the milk is brought to London by railway. A sample is taken of each instalment, and its temperature and density are examined. The density of good milk should be 1029–33. If the specific gravity differs from this, the milk is examined more carefully; and it is not sold as milk, but used for making butter. The Society of Analysts has fixed the minimum amount of fat at 2·9 per cent., of total solids at 11.5 per cent.

The vessels in which milk is brought to town are ordinarily sealed and furnished with a tap near the bottom. They are generally of tin, not painted, but always clean and polished.

Outside these great Companies, which supply absolutely pure milk, there is a large number of milk-sellers, some of whom have cowsheds in the town. It is these particularly who require strict sanitary inspection. They may be classed in two categories—those who water their milk down to the legal limit, and those who render themselves liable to punishment for adulteration. Neither of these can carry on their adulteration with impunity, as the inspection is at unexpected times.

The analysis of samples of milk taken by the inspectors is made by chemists called public analysts (p. 38).

Résumé of the Hygiene of the Soil.—It has been established with certainty that the soil plays an important part in the spread of infectious diseases, the importance varying in different diseases.

Malaria can only be propagated when the pathogenic matter developes in a favourable soil, composed of vegetable matter in putrefaction in association with water. For this reason it only prevails in certain localities. If the poison has entered the human system, it can be conveyed to distant countries, but cannot there be propagated from one person to another.

The pathogenic matters, which, in order to produce a disease, are developed outside the organism, are sometimes called ectogenic matters; and the diseases which they produce are called *miasmatic diseases*.

Another group of diseases is the *miasmatic-contagious*. These, like the miasmatic diseases properly so called, develop ordinarily in the soil before attacking man, but their pathogenic material can, under certain conditions, have directly infectious properties. They can be transported from one locality to another, and there multiply. The types of these diseases are typhoid fever, cholera, dysentery, and yellow fever.

Just as malaria only developes in certain localities, so these diseases require a favourable soil for their propagation. The most favourable soil consists of permeable strata, fouled with human excrement and other products of decomposition from human life.

Pettenkofer has shown that the increase and decrease of epidemics coincide with variations in the level of the subsoil water. When the level of the latter is raised, the microbes cannot escape from the soil; consequently no infection is produced. When its level is lowered, the earth dries, its bacteria become dispersed, and enter the human organism through the respiratory tract. Such is Pettenkofer's theory.

It is however more probable that the spores of bacteria in the soil find their way by means of the subsoil-water into wells or other sources of drinking-water, and thus infect the system by the digestive tract.

Proper drainage of the subsoil is an important means of preventing the spread of infectious diseases. By this means the upper layers of the soil are dried, and organic matters become transformed into nitrites. In filtering through the deep strata of the soil, the water becomes purified from bacteria. Statistics prove that typhoid fever diminishes in towns where the drying of the soil is effectual. This disease can therefore, up to a certain point, be regarded as indicating the sanitary condition of a locality; and it is thus employed by statisticians.

A third group of specific febrile diseases has been called *contagious diseases*. In these the pathogenic material is conveyed directly from one person to another. It forms in the system, and on leaving it is ready for direct propagation.

A special predisposition for the propagation of such contagious diseases is doubtless required. Were it not for this fact, owing to the rapidity of communication among civilized nations, an epidemic would rapidly spread from one nation to another; whereas, as a matter of fact, it usually remains a considerable time in the same district.

For this reason it is necessary to admit an influence due to time as well as a local predisposition. It remains to consider in what this consists. As the struggle for life is perhaps greater in the world of microbes than in other groups of organisms, and as one can imagine that each species of microbe has another antagonistic to it, it seems probable that the occurrence in a locality and at a certain time of a greater or less quantity of these antagonistic microbes is the chief cause of predisposition as to time and place.

Scavenging of London.—To prevent contamination of the soil, the most effectual measures have been taken. In London, as in the rest of England, the sanitary authorities are required to maintain the paving and cleanliness of the streets, and of public places, and courts.

In certain parts of London, the Vestry or District Board itself undertakes the scavenging; in other parts it is let out to contractors.

The system of scavenging varies in different parts of London. It is evident that the procedure suitable for suburban districts, with few passengers and wide streets, would not be applicable to the busy streets of the city.

The paving differs greatly in streets, but considerations of health demand not only a durable and uniform carriage-road, but one that is impermeable, so as to prevent pollution of the soil. The most frequented streets are in practice paved with wood on a bed of concrete. When new paving is required, wood is now commonly used, instead of asphalte or cement, as formerly,

The blocks of wood are of a uniform size. They are 6 inches deep, 9 inches long, and 3 inches wide. They have been soaked in tar. They are placed side by side on a bed of concrete, tarred anew, and then sprinkled with sand. A uniform impermeable surface is thus formed, which is not disagreeable to the horses, and which muffles the noise of the traffic. The repair and maintenance of this paving are very easy. The old blocks are used as firewood.

In addition to pavings of wood, asphalte and cement, macadam and stone paving are used. In some remote parts there are still some streets paved with flints.

In the most frequented streets of the city, boys from ten to fifteen years of age are placed at intervals in the streets, with shovel and brush. They glide with great skill among the carriages and collect the horse-droppings, which they place at once in vertical iron boxes, about $3\frac{1}{2}$ feet high, closed above by a lid. These boxes are placed at intervals on the edge of the pavement. The refuse thus accumulated is removed each night.

In dry weather the streets are watered before being swept, the small streets by hand-brooms, the large streets by brushes drawn by a horse. The latter are cylindrical brushes placed obliquely in relation to the road, so that the refuse is brushed to one side. The manure and dirt are removed by means of carts in which it is taken to depôts, generally close to the Thames, or a railway station, sometimes to a brick-yard. The same depôt receives the house refuse. Each house has a *dustbin* or *ashpit* for such refuse. This receptacle, made of masonry, or preferably of galvanized iron and movable, is ordinarily placed in a small cellar under the pavement of the street or in the backyard. The kitchen being commonly underground in London, there is easy access to this ashpit.

The house refuse is removed in most districts weekly. In some districts a card with the letter D upon it is placed in the window when removal is required.

At the depôts, the house-refuse is sorted, and utilised according to its nature, or burnt without previous sorting in special furnaces. For districts most nearly rural, the plan preferred is to convey the refuse directly into the country.

Stable refuse in the best mews is collected in *movable wire-work gratings*, forming carts with four wheels, the sides and bottom of which are of iron grating. When the cart is full, it is immediately removed.

The necessary depôts for refuse are subject to the following genera regulations :—

1. The depôts must be as distant as possible from inhabited places.

2. The refuse must not be put into pits, but above the ground-level. If necessary, a special floor 3 inches above the ground must be made.

3. The ground should be drained, and paved with impermeable material.

4. The depôts should be sheltered from sun and rain, but the air should enter freely.

5. The ground leading to the depôt should be well paved, so as to prevent pollution of soil.

Letts' Wharf and Dust Cremator.—For the use of the city, a furnace has been erected at Letts' Wharf, Commercial Road, on the south side of Waterloo Bridge. As all the refuse cannot be thus disposed of, sorting is also carried on.

In the middle of the yard, which occupies an area of 5 acres, are erected the furnaces, which are of two kinds. In the new furnaces, the refuse is thrown in at an opening near the top. A vast storeyard on the level of the top of the furnace serves for storing the refuse before it is burnt. In the old furnaces the refuse is admitted from below. They communicate with a high chimney, and have special arrangements for the combustion of the smoke.

Near the furnaces are covered sheds for the sorting of refuse which cannot be burnt. The grosser matters, such as hay, straw, rags, bits of wood, are first separated. The workmen are authorised to take away with them as much wood as they wish.

The grosser matters being thus separated, the other matters are dealt with as follows :—

The workpeople are divided into groups, each consisting of a man with a shovel and four to five women having each a coarse sieve. The refuse being thrown into each sieve, cinders and small lumps of coal are separated ; other waste materials being placed in heaps or in baskets.

Rags, paper, old shoes, iron, glass, bones, old pots and tins, oyster shells, bottles, shells, vegetable stalks and leaves, form also separated heaps. There still remain small particles of coal and coke which are separately piled.

Rags and paper are put in sacks and sent to paper manufacturers ; the old boots are exported to Germany and France ; the iron is sent to foundries ; the glass, divided into three qualities by boys, is sold to glass manufacturers ; the bones are sent to mills, while the bits of pottery-ware and tin, and the hard clinkers from the furnaces serve as road material. The bottles and pots, especially ink-pots from City houses, are employed anew. The ashes and cinders are conveyed to brick-yards and there the cinders are used in heating the kilns and the ashes for mixing with the clay.

A special grinding machine composed of horizontal cylinders revolving round a centre, pounds the oyster-shells.

The *soft core*, consisting of vegetable and animal matter, is burnt. When the furnace is not available, they are conveyed into the country.

As already explained, the street droppings in the most frequented streets are immediately swept up and collected. They are ordinarily employed in gardens, as is also the stable refuse.

The refuse from other streets, which on account of rain or of watering of streets is in a semi-liquid condition, is brought to Letts' Wharf, where it is placed in two shallow reservoirs. The bottom of these is of flagstones, the sides boarded to a height of about 20 inches. The moisture escapes by means of trenches into the river. A solid black mass remains, which is conveyed by barges into the country, where it serves as manure.

Letts' Wharf has alongside the Thames a large quay and a dock for numerous barges and arrangements for embarking refuse. Workmen's dwellings, stables for thirty horses, and the necessary sheds open on to the street. The horses which are at least $6\frac{1}{2}$ feet high, are very powerful. The size of the carts employed for conveying refuse is in proportion to the enormous size of these horses.

The stables are paved with brick, behind the stalls is a gutter to drain off the urine, which is frequently washed to keep it clean. In addition to the straw which is brought to the yard with other refuse, and which is used for litter if in good condition, peat imported in bales is also employed for the same purpose.

In the yard no disagreeable smells are perceived. The dust is not troublesome, as the refuse is rarely quite dry.

Cattle Markets.—The London cattle markets are the *Metropolitan Cattle Market* in Copenhagen Fields in Islington for cattle from the country, and the *Foreign Cattle Market* at Deptford, near the Thames, for foreign cattle.

The Metropolitan Cattle Market covers an area of 30 acres. It is an immense space, paved, and surrounded by a high iron fence. In its middle is a circular building surmounted by a clock. Here are the offices of the employés, the post and telegraph office, bank, exchange, offices of traders, etc.

On the east side of this building are places for cattle, and on the west for sheep, etc.

The horned cattle are placed within strong iron barriers in double rows ranged 25 to 50 feet in length, and separated by passages 20 feet wide. The cattle are tied so that their heads are opposite each other; the intervals between two bars is 10 feet.

The place for sale of sheep is covered with small square pens, having free passages between each of them.

A pen 30 feet square holds from five to twenty sheep. To the west of this place are covered markets for calves and pigs, separated from one another by a street 32 feet wide. The enclosures for calves are 36 feet square, for pigs 25 feet square; they are arranged in squares separated from each other by passages.

The ground of the market slopes slightly to facilitate the removal of impurities. The market will hold 10,000 horned cattle, 40,000 sheep, 3,000 calves, and 2,000 pigs.

The chief market days are Mondays and Thursdays; during certain hours of other days the market may also be used.

The cleansing is done with great care. The solid excrement is removed daily in carts; and there are numerous water-taps for daily cleansing.

At each of the four corners of the market is a round building containing four water-closets and a large number of urinals. The closets are placed centrally, the excrement falling into a trough common to all, full of water; on market days this is emptied and cleansed by employés. On removing a plug, the trough empties itself directly into the sewer. The urinals are arranged circularly in the interior of the building; a permanent current of water washes their walls and flows into a trench at the ground-level and thence into the sewer. There is no smell.

Abattoirs.—To the east of the market described above, but separated from it by streets, are public abattoirs for cattle and pigs, and to its west stalls for sheep, etc., and to the south for cattle. On two sides of the latter are abattoirs for sheep and other small animals. Further to the east is a private abattoir and an establishment for the preparation of albumen and of guano from blood.

The ground in the stalls and yards is paved. The animals are foraged and cared for by men of the establishment. Sales are effected in the stalls. When an animal is sold, the hair of its tail is cut to distinguish it from the others.

The public abattoir is separated from the street by a high wall. To the left of the gate are slaughter-houses for pigs; and cattle may also be slaughtered here. The pigs are knocked down with a poleaxe. They are scalded before being eviscerated. It is forbidden to singe them on account of the unpleasant smell.

To the right of the gate are slaughter-houses for cattle, in a large isolated building. These slaughter-houses form separate compartments, each comprising a slaughtering-room and a lair for cattle. The slaughtering room is from 220 to 440 yards square; and here the meat is hung until it is removed. The floor is of perfectly water-tight cement, sloping slightly towards gutters which allow waste water to escape into the drains. The blood is collected in special receptacles. The walls are of Parian cement, so that they can be washed. There is no ceiling. Just below the roof the wall is perforated with holes to admit of ventilation.

Slaughtering is done as follows: the bullock is tied and one slaughterman seizes the animal by the horns and raises its head so that the forehead is horizontal. By means of a poleaxe a blow is inflicted here which immediately deprives the animal of consciousness. Through the hole in the skull produced by the poleaxe, a large sound is inserted to destroy the base of the brain and the spinal marrow. At the same time the jugular veins are opened; the blood is collected in large vessels and taken to

the albumen factory. After each slaughtering the slaughter-house is cleansed.

The animals do not appear to suffer by this method of killing; the living beasts are in a separate lair, and are only admitted one at a time to the slaughter-house.

The offal is emptied outside; the ordure and other refuse are conveyed in small trucks to a special yard, where are also deposited litter, refuse from stables and markets. On one spot is placed a bed of litter; this is covered with ordure and then covered with a quantity of dry refuse from the courts and neighbouring streets. The excess of water is absorbed by the litter. At the end of a few days the mixture is ready for removal, and has no very penetrating smell.

One cannot however say that the public abattoirs of the Cattle Market are model abattoirs.

The Cattle Market, like the Smithfield Market, is under the control of the Markets Committee. The Clerk of the Cattle Market is charged with the inspection of the abattoirs. He has under him two officers who receive the dues, and two inspectors who supervise the cleansing of the abattoirs and prevent the introduction of diseased animals except into special lairs.

In London beasts are only allowed to pass through certain streets, and not after midday. Each herd is conducted by a driver, who must see to the precise carrying out of all regulations.

The Foreign Cattle Market at Deptford, on the south side of the Thames, occupies an area of 27 acres. The beasts are only disembarked twelve hours after their arrival; and during this interval are inspected by veterinary surgeons. There are lairs and abattoirs similar to those of the Metropolitan Cattle Market. The manure and refuse from slaughtering is removed in barges.

The slaughtering of animals outside of public abattoirs is not forbidden. Each butcher may have his own slaughter-house provided its position and arrangements as to construction and ventilation are approved by the sanitary authorities. The law in this respect contained in the Slaughter-Houses Metropolis Act, 1874, is very severe. Private slaughter-houses are also subject to special bye-laws and are frequently inspected. It is evident however that the control over diseased meat in them cannot be so complete as in public abattoirs.

The walls of slaughter-houses are required to be lime-washed once a month, the floor to be of cement or asphalte or well paved; and a sufficient water supply and drainage to be provided. Waste offal is required to be removed daily. In other respects the same regulations as for slaughter-houses in the whole country apply (p. 34).

Résumé of Drainage Systems.—The unpleasant effluvia from human dejecta have gradually led to the discovery of more perfect means of getting rid of them. The necessity for their removal and destruction has been more thoroughly realized since it has been known that pathogenic poisons may be contained in them.

The necessity for effective measures in this respect increases with the density of population.

The oldest system, consisting of a pit in the ground, into which are directed excrement and waste water, causes pollution of the soil, air, and water of wells. Cesspools, with walls of masonry or timber, are but a modification of this system.

All efforts to prevent the soil from becoming infected from such cesspools have been ineffectual. They may succeed for a time, but eventually the thickest walls become saturated. The researches of Wolffhügel at Munich appear to show that soakage may occur by capillary action even from water-tight cesspools. He found the soil about such cesspools fouled, and containing considerable quantities of nitrogenous matter, although the cesspools were lined with cement inside and outside, and appeared water-tight.

In England, the floors of privies are required to be at least three inches above the ground-level, and to be emptied at least once a week (pp. 73 and 86).

In the system of movable receptacles, the receptacle is removed along with its contents. This is preferable to fixed privies. The pail system, however, has not been found to answer well among working-class populations, and generally among all who do not understand the importance of cleanliness and order. Even supposing that by the exercise of great care we prevent the origin of mischief from this system, the offensive character of the excrement cannot be overcome. A more or less offensive odour is always emitted, the air is infected. The night-soil men may be the means of spreading pathogenic material. Wherever an infected pail is conveyed, it causes fresh infection. The disease is not destroyed, but transferred.

To remedy these evils the attempt has been made to mix the excrement with substances capable of destroying their pathogenic material, or removing their offensive character. Thus the excrement has been treated with chemical disinfectants; but this method has not been generally adopted. The application of dry earth, ashes, sawdust, etc., has, however, been found very advantageous. In England dry earth has been used to a considerable extent, under the name of the earth-closet (pp. 72 and 85). It has been thought that the mixture of earth and excreta, being a good manure, would not only cover the cost of clearing, but would realize a profit; but this anticipation has not been realized. The mixture is bulky, and does not pay for transport, nor can it compare in value with artificial manures.

Prof. E. Frankland has found that the mixture is not a very powerful manure. In 100 parts there are 6·671 of organic matter (of which 0·207 are nitrogenous); 66·782 of mineral matter (of which 0·326 is phosphoric acid); and 25·547 of water. This is explained by the escape of the water as carbonate of ammonia.

According to Kœnig, the mixture contains 79·5 to 89·9 per cent. of water, 10 to 17·5 per cent. of organic matter (0·36 to 0·76 per cent. nitrogenous), and 1·2 to 5·6 per cent. of mineral matter (0·18 to 0·51 per cent. phosphoric acid, and 0·17 to 0·40 per cent. potash).

The most efficient means of preventing infection from infected excreta is undoubtedly their cremation, and this system is partially applied in several towns.

The only system fulfilling hygienic requirements as to rapid and inoffensive removal of excreta is the water-carriage system as used in England. The mass of water (two gallons) with which each excretal mass is mixed by flushing, the perpetual movement of water in the sewers, and the low temperature in them, are unfavourable to bacterial development. Pathogenic microbes perish in a mass of water, by virtue of its movement, the great dilution, and their conflict with non-pathogenic microbes, perhaps also as the result of other unrecognised factors.

This system is objectionable, because of its fouling so large a mass of water. It is however a mistake to suppose that fæces pollute sewage water more than other waste matter discharged into the sewers.

Sir J. Lawes and Dr. Gilbert estimate the fresh fæces of an adult man at 4·17 ounces daily, the urine amounting to 50·18 ounces. When dried, the fæces weigh 1·041 ounce, the urine 1·735 ounce; thus the amount of solid matter in the daily urine is 40 per cent.

greater than in the daily fæces. This is difficult to realize, owing to its being in solution, and there is much hesitation in allowing fæcal matter to enter the sewers, but none as to urine and other waste water. Practically the presence or absence of fæces makes but little difference in the foulness of sewage.

English experience, and that of the great towns of Europe and America, have shown the erroneous character of the fears expressed in this respect. The fæcal matter becomes broken up and dissolved in the sewers, and causes no greater nuisance than other waste materials. The disintegration is so complete that it is impossible to discover in the chief sewers solid excretal matter.

We have said that this system deprives the earth of valuable manure, and thus causes a national loss. The numerous attempts made in all countries to profitably use the sewage of large towns have hitherto proved unsuccessful, with the exception of a few irrigation farms.

The pneumatic systems, such as those of the Dutch engineer Liernur, and the French engineer Berlier, are too complicated to be practical.

Systems of Water-Closets.—In London no form of closet is allowed except water-closets and earth-closets. Earth-closets are daily diminishing in number, and all new houses are provided with water-closets.

The essential conditions of good sanitation in England are a pure water supply and complete system of house-drainage. The details of drainage have attained, when efficiently carried out, a perfection which leaves little to desire.

A large number of different water-closets are now in use, which have reached a high standard of perfection.

The old-fashioned double pan-closet, with its necessarily foul container,

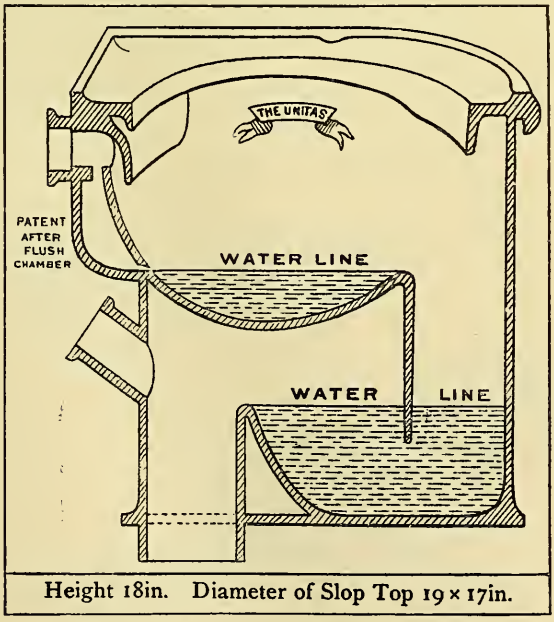


FIG. 33.—SECTION OF WASH-OUT CLOSET.

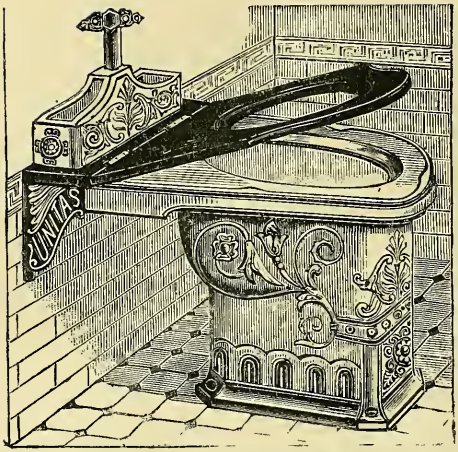


FIG. 34.—WASH-OUT CLOSET, SHOWING MOVABLE SEAT, SO AS TO ALLOW THE CLOSET TO BE USED AS A SLOP-SINK OR URINAL.

often rendered worse by a D-trap beneath, is being rapidly superseded by more sanitary closets. Of these the most important are the wash-out, the short-hopper, and the valve-closet, with various modifications of these.

Wash-out closets are largely in use. They may be either *side-outlet* or *front-outlet closets*, according to the position of the connection with the syphon-trap under the pan. To prevent the fæces sticking to the bottom of the pan, the latter always has a shallow layer of water remaining in it after each flush. By pulling a handle, two to three gallons of water are discharged from a flushing cistern above the closet by means of a pipe at least $1\frac{1}{4}$ inches in diameter. A syphon trap is placed under the pan, and

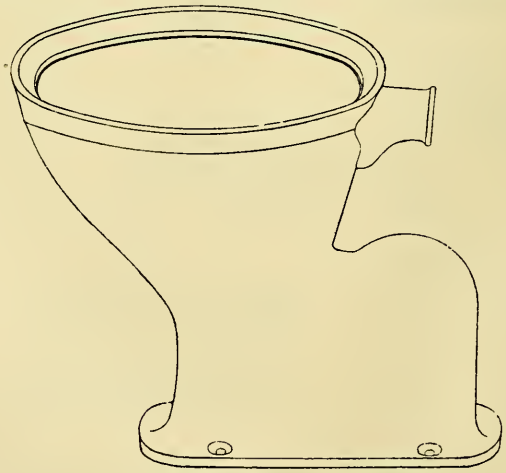


FIG. 35.
WASH-DOWN CLOSET.

the junction with the soil-pipe beyond is commonly ventilated by means of a shaft.

The advantage of these closets is their simple construction, and the fact that not being concealed behind wood-work, defects are easily detected. The back of the pan is curved to form an after-flush chamber, thus enabling some water to remain in the pan after each flush.

The flush of water usually suffices to remove all impurities into the soil-pipe beyond the trap. The height of the closet is sixteen to eighteen inches; the pan varies from fifteen to nineteen inches.

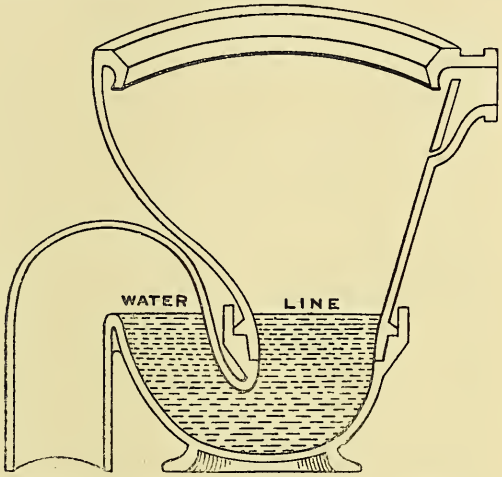


FIG. 36.—SECTION OF WASH-DOWN CLOSET.

The *wash-down closet* shown in Figs. 35 and 36 is simple, practical, and cheap. It is practically identical with what is known as the *short-hopper*,

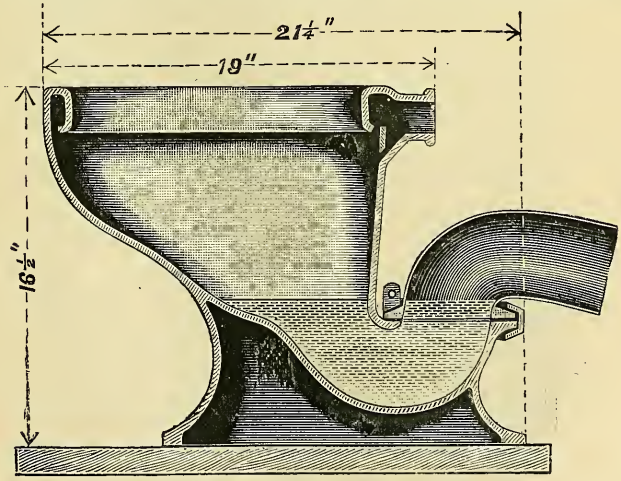


FIG. 37.—THE "PURO" WATER-CLOSET.

except that it is made in one piece of earthenware. It is, in our opinion, preferable to the wash-out closet, as it exposes a smaller surface for fouling.

Fig. 37 represents an excellent form of short hopper closet made by Winser. The connection between the earthen trap and soil-pipe is under the water-line, thus ensuring absolute protection against the escape of sewage-gas. The closet not being encased in woodwork, any leak is at once detected.

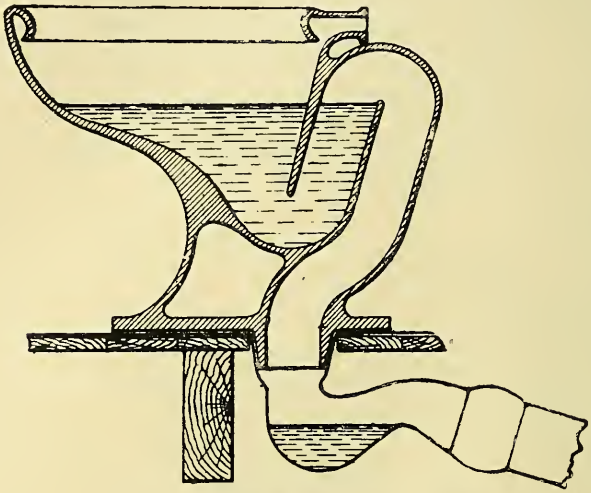


FIG. 38.—SECTION OF DECECO CLOSET.

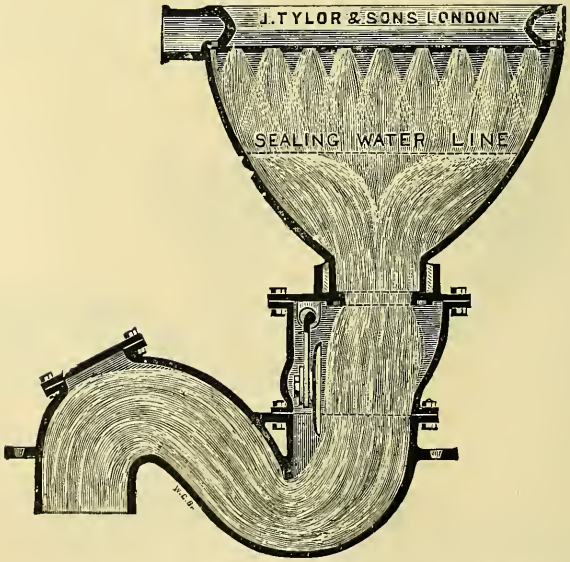


FIG. 39.—SECTION OF VALVE CLOSET AT MOMENT OF FLUSHING.

The *Dececo closet*, shown in Fig. 38, is a modification of the wash-down closet, in which the ascending arm of the syphon-trap is continued upwards, so that a deeper water-seal is formed. In addition the descending arm of the syphon ends in a second syphon before it joins the soil-pipe.

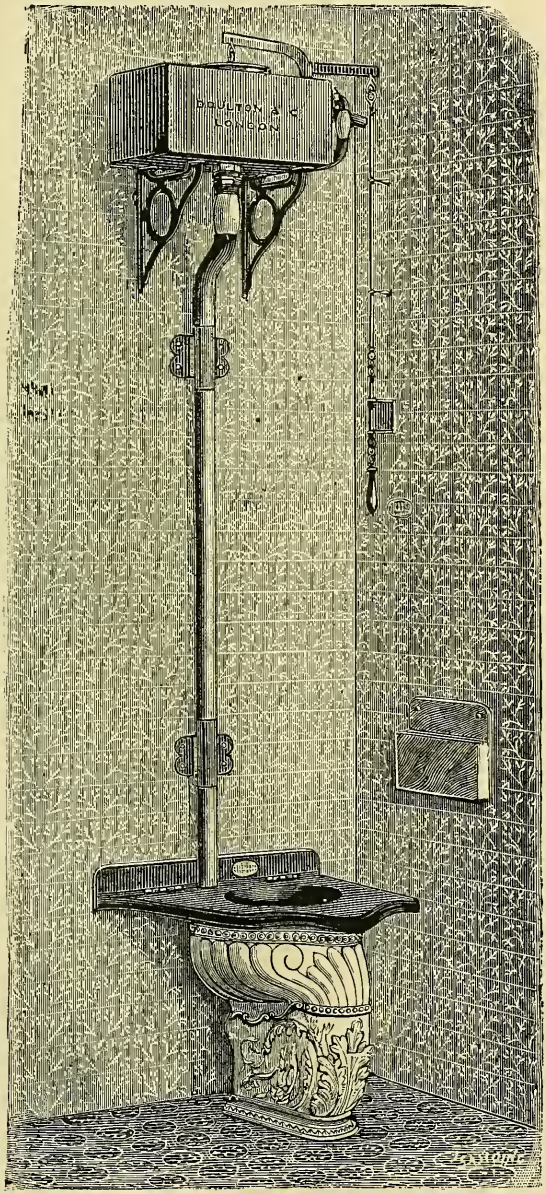


FIG. 40.—WASH-OUT CLOSET WITH FLUSHING CISTERN.

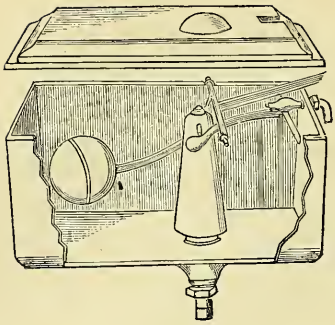


FIG. 41.—WATER-CLOSET CISTERN.

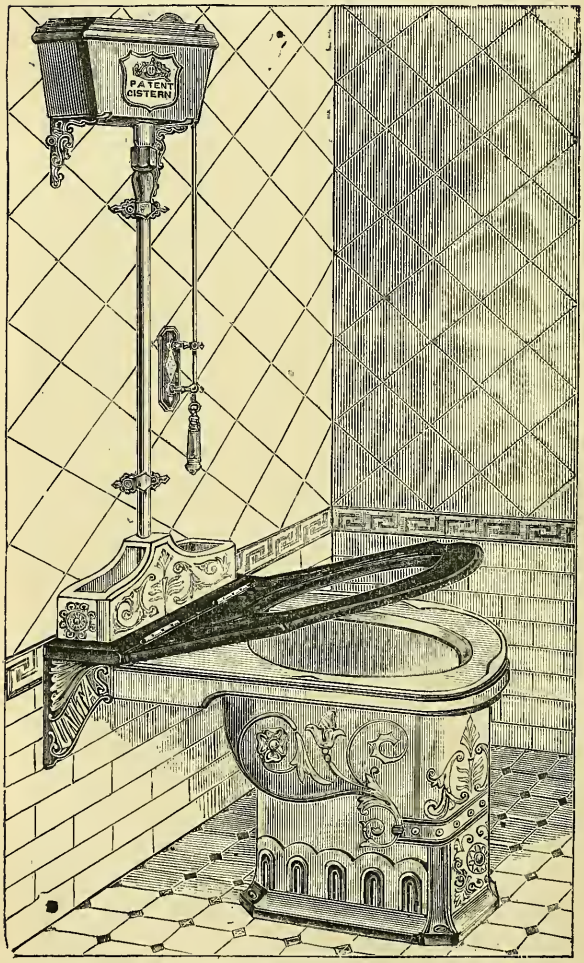


FIG. 42.—SIDE VIEW OF WASH-OUT CLOSET, SHOWING MOVABLE SEAT AND FLUSHING ARRANGEMENTS.

When the closet is flushed, syphon action is started by the incoming water, and the contents of the basin are thus rapidly extracted.

The *valve-closet*, although the most expensive, is probably the best for indoor use. It is seen in the act of flushing in Fig. 39. In addition to the syphon-trap below, there is a valve, which maintains water in the pan, and thus prevents the entry of sewer-gas into the house, even should the trap underneath become unsyphoned.

Each closet is furnished with a special cistern for flushing purposes. The arrangement of these cisterns is such that it suffices to draw the handle (Figs. 40, 41, and 42), to allow of the escape of two or three gallons of water.

These cisterns fill themselves by means of an automatic ball-cock (Fig. 41), composed of a lever, of which one end is a hollow ball serving as a float, and the other end forms a hinge. When the water escapes, the ball falls and opens a supply-pipe; the cistern gradually fills, and when the level again becomes horizontal, the water is stopped off.

In some closets the valve of the cistern is in direct connection with the seat of the closet, so that the closet is automatically flushed when its seat is vacated.

Water-closets among the wealthy classes are generally placed within the house in a room which admits, if possible, of cross-ventilation. When they are of the forms shown in the preceding figures there need not be the slightest smell from them.

In poor districts the water-closets are generally placed in the back-yards. In private-houses, water-closets have ordinarily only one pan, when intended for only one family.

In public establishments trough-closets are often used. These generally consist of a horizontal reservoir, above which are several seats, and which is half full of water, so that the excreta do not become adherent to the

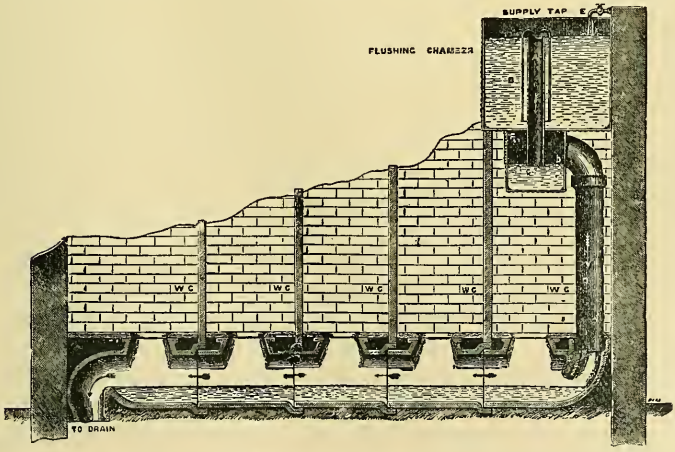


FIG. 43.—TROUGH CLOSET WITH AUTOMATIC FLUSHING CISTERN.

bottom or sides. The person in charge flushes these closets at intervals by means of a large quantity of water.

Closets of this kind supplied with automatic flushing cisterns are flushed at definite intervals. The closet shown in Fig. 43 is by Bowes, Scott & Read, of Westminster. The automatic flushing cistern is the invention of the celebrated sanitary engineer, Rogers Field. The water enters by the tap **E** into the cistern **B**, and when the syphon **A** is set in action, the contents of the cistern escape by the pipe **D**, driving the contents of the trough-closet into the drain by their sudden rush.

This system has been recommended by the Local Government Board, and has been introduced into schools, barracks, prisons, workshops, and factories, etc.

In introducing water-closets, the following general rules should be adopted. The pans should not be encased in wood. The best are made of enamelled earthenware. Each water-closet must have its own flushing cistern. The latter should only hold sufficient water for each flush, and should be provided with an overflow-pipe, discharging into the open air, in the event of the ball-cock getting out of order.

Under the closet a zinc or lead safe-tray should be placed to catch any water which may, by bad management, have been spilt. This is provided with a waste-pipe, which must not be connected with the trap of the closet or the soil-pipe, but be made to discharge into the open air.

Drainage of Houses.—In addition to the soil-pipe discharging the contents of water-closets into the drains, there are other pipes for the discharge of waste kitchen water, and waste water from baths and lavatories.

The arrangement of these pipes is described in the model bye-laws (see page 77 to 78), published by the Local Government Board.

The soil-pipe and waste-water pipes of private houses are generally carried down the external wall of the house to avoid the escape of foul gases into the rooms in the event of leaks arising. The soil-pipe is continued upwards above the roof, clear of all windows and chimneys, having its upper end open and surmounted by a ventilating cowl or wire-work. It ought to have a diameter throughout equal to that of the soil-pipe; and in order to prevent unsyphoning of the traps of water-closets placed on different storeys above each other, each syphon-trap should be ventilated by an additional pipe connected with the soil-pipe ventilator above the level of the highest w.c. The pipe from each w.c. should be obliquely connected with the soil-pipe, and have air-tight joints.

The pipe for inlet for fresh air should be on a lower level than the outlet ventilator at the back of the house, and should be placed on the house side of the intercepting syphon-trap between the house-drain and sewer.

The waste-pipes of sinks and baths should be furnished with disconnecting syphons, in addition to opening below over gully-traps in the external air. Baths are furnished like valve water-closets, with a safe-tray for accidental overflows; the waste-pipe from this should not be connected directly with the drain.

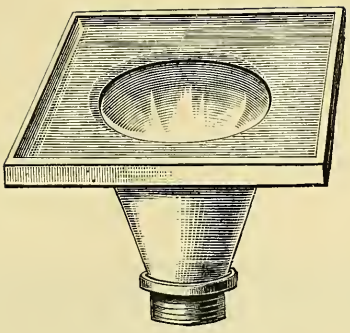


FIG. 44.—SLOP SINK.

In large houses it is often desirable to have slop-sinks separate from water-closets. They should be furnished like water-closets with syphon traps, and be ventilated on the further side of the trap.

Waste-pipes should run in straight lines, and have sufficient fall; they should be circular to facilitate cleansing and diminish friction of water.

Underground drain-pipes are usually of earthenware, occasionally of iron. The joints of the former are made water-tight by means of cement. Occasionally clay has been used, but this is objectionable as clay cracks when dry, and the fibrils of tree-roots find their way into the joints and cause obstruction in the drain.

Iron pipes should be tarred in their interior, and the joints made water-tight by means of lead.

Two pipes should not join at a right angle. At every change of direction there should be means of access to enable the drain to be examined. For an ordinary private house pipes four inches in diameter are sufficiently large, for an hotel six inches; only for very large buildings are nine-inch pipes necessary. To prevent as far as possible the occurrence of deposits, pipes of greater diameter than six inches should be avoided. For the same reason the fall of the pipes should be sufficient. In general, it is necessary

For pipes 4 inches in diameter to have a fall of 1 in 40.
„ 6 inches „ „ 1 in 60.
„ 9 inches „ „ 1 in 80.

If the fall is less, or if deposits occur from other causes, special means of cleansing are required. A large sudden flush of water is sometimes sufficient; to simply allow a number of taps to discharge into the drain at the same time is wasteful without being efficient.

If the supply of water is abundant, it may be used freely for flushing drains. If the supply is limited, the waste water may be retained and then suddenly discharged in a large quantity.

When the current is feeble, automatic flushing tanks may be placed at the upper end of the drain.

Fig. 45 shows such a reservoir known as Rogers Field's *self-acting flush-tank.* It is identical with the one represented in Fig. 43. Doulton and

Co. manufacture other flushing cisterns on the same principle. They have also combined their automatic flushing cistern with a *grease interceptor*. The grease from kitchen plates, etc., is very apt to cause obstruction in house drains.

Rain-water pipes, as well as waste-pipes from sinks, baths, etc., should end below in the open air over a gully-trap, so as to be completely cut off from the drain.

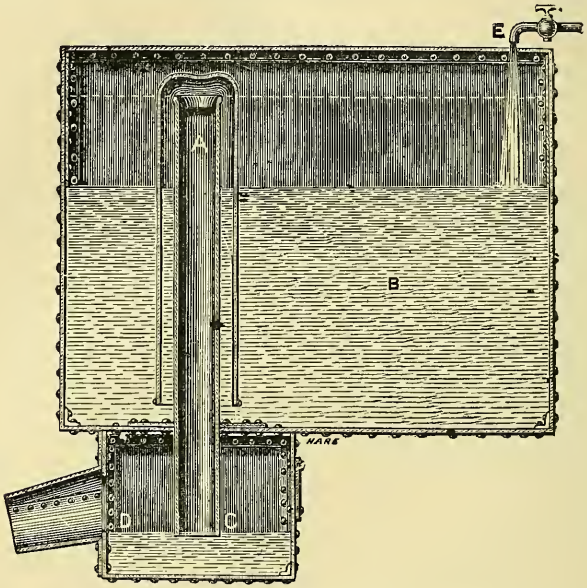


FIG. 45.—ROGERS FIELD'S SELF-ACTING FLUSH TANK.
A—Syphon. B—Water. D—Hydraulic seal. E—Water-tap.

In exceptional cases the rain-water pipe is allowed to act as a drain-ventilator. It is then required that the joints of the rain-water pipe should be air-tight, and that its upper end should be remote from any windows or other points at which foul gases might enter the house.

Gully-traps, whether they serve for the discharge of rain-water or of waste-water into the drain, should be at least eighteen inches from the wall of the house. Their superficial surface should be as small as possible to diminish the evaporation of water. A grease-interceptor, to be frequently cleansed out, is desirable for the gully-trap receiving kitchen water in large houses.

Surface-traps should not be placed in rooms on the ground floor or in cellars, unless this cannot be avoided. It should never be allowed in these exceptional cases, unless the house-drain is efficiently ventilated and has an intercepting-trap between it and the sewer. All surface-traps should be furnished with a movable grating to retain solid substances. The grating should be of a form permitting the easy escape of water. Round holes are objectionable, as they offer great resistance to the passage of water.

In houses of ordinary size, soil-pipes are three to four inches in diameter. When several water-closets discharge into the same pipe, the diameter may be $3\frac{1}{2}$ to $4\frac{1}{2}$ inches; it is rarely necessary that it should be larger. Drawn lead is the best material for soil-pipes, and should be of uniform thickness throughout, equal to 8 lbs. weight per superficial foot, so as to resist contraction and dilatation even if hot water is passed through it.

Iron soil-pipes are even more employed than lead, owing to their greater cheapness, but the joints are much more difficult to make secure. They should be previously tested at a given pressure. The joints should be caulked with lead, and not made with cement. Soil-pipes should be fixed along the wall to avoid deformities and leaks. The joints connected with the closet, and at the junction with the main soil-pipe require special attention. If the soil-pipe is unfortunately within the house, it should have means of access and be periodically examined for leaks.

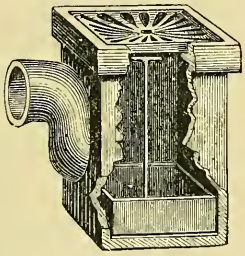


FIG. 46.—GULLY-TRAP, WITH ARRANGEMENT FOR INTERCEPTING SOLID MATTERS.

The syphon-bends in the waste-pipes from sinks and baths should be furnished with a screw at the lowest point, which can be opened for cleansing. Surface-traps may be arranged like Doulton's mud-intercepting trap (Fig. 46), having a quadrilateral receptacle covered with a grating. By means of the handle connected with this, cleansing can easily be effected.

For the syphon-trap between the house-drain and the sewer, the form

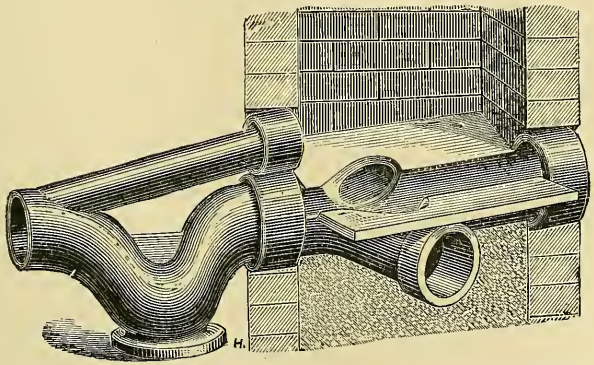


FIG. 47. – THE KENON INSPECTION-CHAMBER AND INTERCEPTING-TRAP.

recommended in the model bye-laws of the Local Government Board (Fig. 17 A, p. 80) may be used.

The *Kenon air-chamber and trap* (Fig. 47), is constructed by Messrs. Doulton in accordance with designs of Messrs. Corfield and Mark Judge. Like other intercepting-traps, it serves to cut off aërial communication with the sewer, and at the same time to facilitate inspection and cleansing. It is made of a single piece of glazed earthenware, placed at the bottom of an inspection-chamber, and consisting of a central open channel into which the waste-pipes from the house open. On each side the floor slopes towards this central canal. At the upper end is the junction with the house-drain; at the opposite end a syphon. A long straight pipe unites the longer arm of the syphon to the chamber, and by its means the drain beyond the syphon can be cleansed. The orifice of this pipe is ordinarily covered by a movable lid. On each side of the channel are openings for branch drains.

A *flap-tap* consisting of iron moving on a hinge is sometimes fixed at the junction of the drain and sewer. It is of little use in preventing the entry of sewer-gas, but prevents rats from finding their way towards the house.

Syphon-traps, however perfectly constructed, cannot be depended upon with certainty to prevent sewer emanations. The water in the trap may absorb and then emit offensive smells. If a storm or a high tide fills the sewers, the air is forced out and may escape through the traps into the house. For these reasons, sewers and drains should be well ventilated. The best means for preventing the formation of sewer gases are the avoidance of deposits and free ventilation. A system of drains furnished with efficient traps, and well ventilated and flushed, should altogether prevent the formation of noxious gases.

General Rules as to the Construction of Sewers.—Sewers will vary in size according as they are intended for sewage only or for rain-water as well. The first system, known as *the separate system*, is strongly recommended for small towns, as being less costly than the combined system; it is also highly praised by some for large towns, because the flow of sewage is more constant, and it is therefore less difficult to render it inoffensive.

In the combined system the sewers are relatively large; consequently in dry seasons the current is insignificant, and deposits are apt to occur. In the combined system, it is necessary to take into consideration the construction of different parts of a town. In those parts fully built upon and with well-paved streets, the rainfall finds its way immediately into the sewers; while in those parts with scattered houses and where there are gardens, the rain is absorbed in great measure by the soil and plants.

The current of sewage should be at least $2\frac{1}{2}$ feet per second, to prevent deposits with a constant current; with an irregular current the minimum rapidity should be three feet per second. A current exceeding four feet

per second should be avoided, as it would drive gravel and other hard solids along and be likely to damage the interior of the sewer.

If the fall of the ground is considerable, a sewer of the higher parts of the town should not discharge into a sewer in the lower parts, as in the latter the current is less rapid, and in the event of a sudden shower the sewer might burst with the combined system.

Sewers in a low-lying district at sea-level may not discharge their contents easily, and in this case also the sewers at higher levels should be separated from the low-lying sewers.

The ventilation of sewers is effected by means of open grids placed at the street-level at short distances from each other ; shafts being also carried up above the tops of houses at the highest point of each sewer when this is practicable. The ventilation of sewers by street-grids is very simple and efficacious, and in well-constructed sewers with a sufficient gradient is not productive of nuisance. Up-shafts are advisable where any nuisance is complained of from the street-grids, but they only influence a comparatively short length of sewer.

The sewer-gases of unventilated sewers may be fatal to man ; while the air of a well-ventilated sewer is no worse than than of a stable or of a room full of people.

The distance between individual sewer-ventilators should not exceed 100 yards. If disagreeable gases escape from a sewer-ventilator, deposits in the sewer should be removed and prevented, and a more efficacious ventilation provided. In well constructed sewers, ventilation suffices to prevent bad smells, but not so in defective sewers. For the latter filters of wood carbon were formerly employed. Inasmuch as this hindered the circulation of air, the ventilating surface required to be increased. The carbon filter should have about 7 square yards of surface for every 50 square inches of surface of the ventilating opening. The meshes of the wire-work of the filter should be about an eighth of an inch wide ; the particles of carbon should be about the size of a grain of coffee, clean, and not covered with dust. The thickness of the filter should be from one-fifth to one-third of an inch. The carbon should be carefully preserved from wet, as it is then less absorptive than when dry ; and twice a year the filter should be changed.

Carbon filters and other similar appliances can only be regarded as palliatives, and have fallen into disuse. Sewers from which foul emanations arise should be repaired or reconstructed, so that ventilation may suffice to keep them inodorous.

Manholes for inspection of sewers should have a movable cover at the ground-level. The best have a ventilating opening at the side (Fig. 48).

The two upper diagrams represent longitudinal and cross-elevations ; the two lower plans at the top and at A A respectively. Manholes should be provided with iron steps for the sewer-men, and with a groove for a sluice if required.

Ventilating openings should be placed at the junctions of all branches of sewers. The ventilation of sewers exposed to tidal action requires special care. Sewer air tends to be driven back in the sewers which are tide-locked, if there are not numerous ventilating

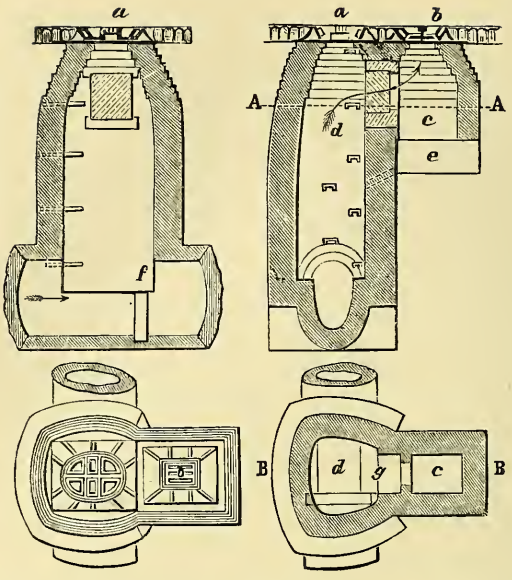


FIG. 48.—MANHOLE AND SEWER-VENTILATOR (AFTER DOUGLAS GALTON).

a. Street level. *b*. Ventilating opening. *c*. Ventilating shaft. *d*. Main passage down to sewer (manhole). *e*. Coarse gravel for draining. *f*. Flushing groove. *g*. Charcoal basket.

openings. Ventilating-shafts equal in diameter to half that of the sewer are recommended for this purpose.

The outlet of sewers into the sea or a river should either be below low-water mark, or provided with a flap-valve to prevent the sewer-gases being driven back by wind.

If the quantity of sewage in a sewer is fairly constant, or if the minimum quantity is at least one-half of the maximum, a sewer of circular section answers well. If on the contrary the quantity of sewage varies greatly, a sewer of ovoid section is preferable, as in this the rapidity of the current is but little affected, even though the quantity of sewage is very small.

A too rapid fall should be avoided in sewers, or damage may occur during storms. Earthenware sewers should always be placed on concrete, especially when the fall is sharp.

Sewers should be water-tight. If leakage occurs, deposits of solid matter and even obstructions are produced, and the surrounding soil becomes polluted. To prevent such soakage from accidental faults, sewers in a porous soil should have an additional casing of clay.

Brick sewers are cemented. If the soil is wet, arrangements must be made for its separate drainage.

Iron pipes are very good in soils which are sandy or marshy, and in narrow streets if a great depth is necessary. They should only be two-thirds the size of earthenware or brick sewers.

The principal sewers should have special overflow-pipes for storms of rain. The junctions of sewers should never be at right angles, but join in the direction of the flow of sewage. At the junctions of sewers and at curves the fall should be a little sharper to obviate the effect of friction. Two sewers of unequal size should not join at the same level, but the smaller one have a fall at the junction equal to the difference in the diameters.

If the branch joins the main sewer below the ordinary level of the sewage in the latter, deposits are produced in the branch.

Sewers more than seven inches in diameter present difficulties as to joints, etc. Larger sewers should be made of brick. Two sewers of the same size should not be made to join, but only sewers of small diameter into others of larger diameter.

In constructing a sewer, lateral eyelets should be left where connections of house-drains will probably be required.

Every precaution must be taken to prevent sewage and sewer-gases from penetrating into the earth. If drainage of the soil is necessary, it should be absolutely independent of sewers, or be connected only by the intervention of a well-ventilated inspection-chamber.

Sewers are flushed by filling the manhole with water, and then removing the plug at the connection with the sewer, when the sudden rush of a large volume of water scours all the sediment out of the sewer. Even with well-constructed sewers sediment may occasionally occur, and flushing should be done at weekly or bi-weekly intervals.

To avoid the entry of solid matters from the streets into sewers, street gullies are provided. They are especially necessary when the street washings enter the sewer. Mud collects in the gullies, while the water escapes into the sewer through an opening at a higher level. The gully-tanks are emptied at intervals as required.

In well-constructed sewers with a sufficient fall, with inspection-chambers and gully-tanks, heavy matters rarely become deposited.

The automatic flush-tank of Rogers Field, previously described, can be employed for small sewers. It may be fed by the overflow water from fountains, etc., which ordinarily escapes without utilization.

In towns with a central system of water-supply, the chambers for flushing sewers may be supplied with water directly from the main. They may also be filled by means of water-carts. Sometimes springs, canals, ponds, or rivers, are so placed as to conveniently feed them.

Purification of Sewage.—The removal of impurities by means of sewers is the method most in accordance with hygienic requirements. The organic matters of sewage are thus prevented from putrefying in the vicinity of houses, and do not pollute the air or the soil.

The system has one serious drawback, viz., the pollution of the streams into which the sewage is discharged.

England was the first country to adopt a system of sewers for the removal of sewage. The sewering of London was begun in 1847, and the other English towns soon followed this example. Sickness and mortality diminished sensibly, but the rivers were polluted. In 1868 the Rivers Pollution Commission was appointed to inquire into and report on the means for avoiding this pollution. Extensive inquiries were made by this Commission, and its reports are among the most important and scientific documents of modern hygiene.

Perhaps the most interesting and practically the most important result of their investigations, is that sewage differs very little in composition, whether it contains fæcal matter or not.

The following table shows the mean result of several analyses of the sewage of sixteen towns where water-closets were used, and of fifteen towns where this system was not applied. The quantities are expressed in grammes per cubic metre.

It follows from these analyses that sewage under the two conditions has practically the same composition, and that sewage requires purification equally under both conditions.

The River Pollution Prevention Act of 1876, which was based on the report of the above Commission, did not recognise any difference between the two cases.

A knowledge of the conditions of life of pathogenic bacteria, shows that the hygienic importance of the infection of streams by sewage has been exaggerated. It has been shown that the bacteria are, so to speak, poisoned in water, and that they cannot escape by evaporation. Pathogenic bacteria are always in a minority; and they perish after a

	Dissolved Matter. (Grammes per cubic metre).					Suspended Matter.	
	Total Amount.	Organic Carbon.	Organic Nitrogen.	Ammonia.	Chlorine.	Organic.	Inorganic.
Towns with water-closets.	824	41·8	19·7	54·3	11·5	17·8	21·3
Towns without water-closets.	722	46·9	22·0	67·0	10·6	24·0	20·5

variable time in the struggle for life with the non-pathogenic bacteria of water, which play the same rôle as the bacteria of putrefaction in the soil.

This explains why, as shown by the experience in England, and especially in London, the death-rate has always diminished as sewerage has become established, although no serious attempts have been made to purify the sewage effluent.

It is however very important to maintain the purity of the water of rivers not only for drinking purposes, but also to avoid the effluvia from mud-banks in dry seasons.

The purification of sewage presents great difficulties. The methods employed for this end are—

1. Chemical treatment.
2. Irrigation.
3. Filtration.

Chemical Treatment.—The principal substance used for precipitating sewage is milk of lime. The lime combines chemically with the dissolved carbonates of sewage, and the precipitated calcium carbonate carries down with it about 60 per cent. of suspended organic matters and 30 per cent. of dissolved matters. As the organic matter in suspension is only about one-seventh of the organic matter in solution, it follows that the greater part of the organic matter is unaffected. Sewage thus treated also has its putrefaction hastened. It has been attempted to prevent this by the use of disinfectants like chloride of calcium, chloride and sulphate of iron, tar, carbolic acid, etc., which retard, but do not eventually prevent putrefaction.

As science has not discovered any substance capable of precipitating all putrefiable matters, chemical treatment cannot be depended upon to render sewage inoffensive.

Irrigation.—The only means of completely purifying sewage is to make it pass through sufficiently thick and extensive layers of soil under cultivation. In the vicinity of Edinburgh, the sewage of the city has been used for two centuries for irrigating meadows, more for economic than for hygienic reasons.

The purifying power possessed by the soil over sewage attracted attention at the beginning of this century, when Gazzeris and Bronner made experiments. Up to 1870 these experiments had, however, no practical application; but then the Rivers Pollution Commission proposed the purification of sewage by irrigation of cultivated land.

Since that time the system has been introduced in over 145 English towns. On the Continent it has been adopted in its entirety at Berlin, Breslau, and Dantzig. The same procedure has been in use at Bunzlau (Germany) for a long time, but in this town fæcal matter is excluded from the sewers.

A part of the sewage of Paris is utilised for the irrigation of fields at Gennevilliers.

Until 1870 it was believed that irrigation acted by mechanico-chemical processes. It has now been shown to be the work of micro-organisms, which first decompose nitrogenous material and urea into carbonic acid and ammonia, the ammonia being subsequently converted by special nitrifying organisms into nitrates. Recent researches show that when air enters the soil with difficulty nitric may be converted into nitrous acid.

For the complete oxidation of organic nitrogen and carbon, a free access of air is the first condition. In addition, a certain temperature is favourable, and a certain degree of humidity of the soil. A chalky soil facilitates the nitrification.

The vegetation of the irrigation field absorbs the products of oxidation for its growth, the soil becoming again ready for fresh sewage.

The usual crops grown on irrigation farms are forage grass, beet-root, turnips, carrots, field-cabbages, and rye-grass. At Berlin an attempt has been made with hemp, and at Breslau with tobacco. In England and at Paris, potatoes, onions, cabbages, haricots, asparagus, etc., have been cultivated to advantage.

The purifying power of the soil has its limits. A maximum of only one acre for 80 to 100 inhabitants should be allowed.

The organic compounds, the carbonates, nitrates, and sulphates are all soluble in water; if formed in greater quantity than the vegetation can absorb, they pass through into the drains.

The soil may even be so saturated that a portion of the organic matters reaches the drains without having been decomposed. For this reason irrigation should always be intermittent.

As oxidation of organic matters depends on the access of air, a porous soil will evidently be preferable for the utilisation of sewage. The extensive experience of England has shown that any kind of soil may be employed, but clay has the least purifying power; and to make it suitable, effectual draining and working of the soil are required.

The following table gives the results of analyses made by Dr. Frankland for the Local Government Board of sewage irrigated through different soils :—

Quality of the Soil.	Percentage of dissolved organic substances retained by the Soil.	Percentage of suspended organic substances retained by the Soil.
Clayey Soil	62·4	100
Ditto	78·4	96
Gravel	74·0	100
Ditto	83·4	100
Light Sand	78·2	93·7
Hard Sand	76·1	93·2
Mixed Clay	88·6	100
Pure Clay	75·0	100
Light Clay	75·0	100
Ditto	75·0	100

To secure complete purification of sewage, organic nutritive materials must be forthcoming corresponding to the wants of cultivated plants. The mean proportion of these substances in sewage and in plants is as follows, according to Kœnig. The quantity of nitrogen is taken as 100 in each case :—

	Nitrogen.	Phosphoric Acid.	Potash.	Lime.	Magnesia.	Sulphuric Acid.	Chlorine.
In the sewage of water-closeted towns . . .	100	26	45	120	25	30	125
In plants. . .	100	48	140	49	22	18	55

It is evident that phosphoric acid and potash are not present in sewage in amount sufficient for the supply of plants. If sufficient sewage to make up for this deficiency is passed over the land, the excess of nitrogenous material enters the subsoil drains, either in organic combination, or as ammonia, nitrites, or nitrates.

The vegetables fed on an over-saturated soil are of inferior quality; the beets are

deficient in sugar, and the grass contains much saltpetre. By alternating crops, and allowing a part of the land to lie fallow, these drawbacks can be diminished.

From a practical standpoint, the method of irrigation is very important. The fields should be divided into sections 30 to 50 feet square, raised in the middle, and having an equal slope. The sewage is conveyed by a culvert to the middle of the section. At certain distances in this culvert dykes are placed, causing the water to overflow on the slopes of the section.

The suspended matters in sewage tend to become deposited on the surface, forming a layer almost like a bed of felt. It may entirely cover the soil and choke the vegetation. In England its formation is prevented by means of reservoirs, in which the sewage stands to allow of suspended matters being deposited. Solid matters may also be separated by a grating or precipitated by means of preliminary chemical treatment.

Winter, especially in cold countries, causes some difficulties in the application of irrigation. The absorptive power of the earth is feeble with a low temperature; there is no active growth of vegetation. Under these circumstances the system becomes one of simple filtration.

When the temperature is under 0° C, the sewage is conducted into large hollow reservoirs in the ground, from which it soaks away. If no preliminary separation of suspended matters has been carried out, the absorptive power of the soil of these reservoirs becomes reduced by the deposit of mud on their sides and bottom. This drawback has been diminished at the experimental irrigation field of Moscow. The soil is raised in ridges, separated by small gutters; the sewage brought into these gutters causes deposits at their bottom, but the sides of the ridges remain for a sufficiently long time permeable to water. The filtration continues, even under a layer of ice and snow, which hinders the diffusion of heat.

From a sanitary standpoint, the system of irrigation has had a most satisfactory effect. Numerous critical observations, especially in England, have failed to show the origin of any case of contagious disease from it.

Filtration.—The Rivers Pollution Commission also investigated carefully the power of different soils to retain the organic constituents of sewage filtered through them at stated intervals. These researches have resulted in the creation in England of a system of purification of sewage, known as *intermittent downward filtration*. Upward filtration, under pressure, has also been tried, but without satisfactory practical results.

The results obtained in these researches are as follows:—

Quantity of sewage filtered per cubic metre of earth.	Percentage of dissolved organic substances retained.	Percentage of suspended organic matters retained by the sand.	Duration of filtration.
	Filtration through pure sand.		
16·7 litres.	84·7	100	24 hours.
24·8 ,,	84·3	100	,,
33·3 ,,	87·7	100	,,
66·6 ,,	65·4	100	,,
	Filtration through sand mixed with lime.		
16·7 litres.	87·3	100	24 hours.
24·8 ,,	86·7	100	,,
33·3 ,,	90·2	100	,,

It will be seen that filtration gives very satisfactory results if the quantity filtered does not exceed 33·3 litres per cubic metre of soil, *i.e.* about 5½ gallons for each cubic yard.

The phenomena are the same as with irrigation. The organic matters become oxidised after the cessation of filtration, carbonic acid, water, and nitric acid being formed.

If one filters only 33·3 litres per cubic metre in twenty-four hours, the purification goes

on uninterruptedly. The filtered water is clear, and nearly colourless; it contains no carbonic acid. It can be allowed to flow into rivers without nuisance, as the greater part of the nitrogenous matters have become nitrified. Such water should not, however, be used for domestic purposes.

The power of purification varies with the nature of the soil. Boggy soil possesses it the least. The filtering power of a soil becomes increased by continued action, as shown by Frankland's analytical results:—

In 10,000 parts.	Matters in Solution.	Organic Carbon.	Organic Nitrogen.	Ammonia.	Nitrates.	Total Nitrogenous Compounds.
Mean Composition of Sewage before filtration	64·5	4·386	2·484	5·557	0	7·060
Sewage effluent on the 13th day	43·8	2·600	1·087	3·631	0	4·077
,, ,, ,, 28th ,,	40·5	2·039	1·223	3·119	0	3·792
,, ,, ,, 35th ,,	45·5	2·150	0·956	4·225	2·088	6·523
,, ,, ,, 42nd ,,	57·8	2·134	0·981	4·000	2·372	6·647
,, ,, ,, 49th ,,	62·7	2·122	1·071	4·740	4·675	9·079
,, ,, ,, 56th ,,	69·8	2·050	1·246	4·063	4·197	8·789
,, ,, ,, 63rd ,,	91·7	2·292	1·172	4·442	4·884	9·385
,, ,, ,, 70th ,,	64·7	1·972	0·931	3·777	4·119	8·160
,, ,, ,, 77th ,,	65·1	1·971	0·388	4·550	6·677	10·812
,, ,, ,, 84th ,,	60·7	1·515	0·357	3·150	4·378	7·329
,, ,, ,, 91st ,,	60·5	1·894	0·217	3·200	3·621	6·473
,, ,, ,, 98th ,,	57·5	1·858	0·183	2·587	3·926	6·239

The purifying power of boggy land is greatest when the sewage does not exceed 23·5 litres per cubic metre in the twenty-four hours. The soil used for filtration is employed in growing cabbages, etc. It is arranged in ridges 18 inches high, and is under-drained at from 5 to 6½ feet deep. The field is divided into sections, each of which is employed for filtration during six hours and allowed to rest for eighteen hours daily. Porous soil is best suited for this system, and one hectare is considered to suffice for 1,000 persons.

The following table from the Report of the Rivers Pollution Commission compares the results of different systems of sewage purification. It is advisable in filtration, as in irrigation, to allow the sewage time to deposit its solid matters, or to have a preliminary

System.	Mean percentage of dissolved organic matter which is retained.		Mean percentage of suspended organic matter which is retained.
	Organic Carbon.	Organic Nitrogen.	
Chemical Purification:			
Best result.	50·1	65·8	100
Worst result.	3·4	0	59·6
Mean.	28·4	36·6	89·8
Irrigation:			
Best result.	91·8	97·4	100·
Worst result.	42·7	44·1	84·9
Mean.	68·6	81·7	97·7
Intermittent Filtration:			
Best result.	88·5	97·5	100
Worst result.	32·8	43·7	100
Mean.	72·8	87·6	100

filtration through a bed of house refuse from the town. A still better result is obtained by subjecting the sewage to a preliminary chemical treatment. The sludge resulting from this procedure is conveyed on to prepared land and dug in ; or it may be pressed into cakes for sale as manure.

The Sewers of London.—Until 1859 the Metropolitan sewers emptied their contents directly into the Thames, causing mud-banks and offensive smells. This arrangement held good from the year 1847, when water-closets came into use, and the old cesspools were, to a large extent, abolished. The river became infected to a great extent, sewage being brought back with the tide to the higher parts of the Thames in London. At full tide water entered the sewers, the flow of sewage was arrested, deposits occurred, and during storms cellars became flooded.

A great number of plans were proposed for the remedy of this state of things. Finally the plan of J. Bazalgette, the engineer to the Metropolitan Board of Works, was adopted, for the construction of large intercepting sewers, running parallel with the Thames, and discharging a long distance from the town, so that there would be no risk of reflux from tidal action. To further secure this end, the sewage ought only to enter the Thames at ebb tide, so that it might be drawn towards the sea.

This immense scheme was begun in 1859, and completed in its principal parts in 1865. The construction of the lower intercepting sewer on the north bank of the Thames, which presented many difficulties, has been going on since 1875.

It was evident that natural gravitation should be used as far as possible in causing the flow of sewage. For this reason, having regard to the natural slope of the ground, three parallel sewers were constructed on each bank of the river at different levels, but each above the level of the water. These are called the *High Level Sewer*, *Middle Level Sewer*, and *Low Level Sewer* respectively. The fall was sufficient for the two first ; for the last pumps have been required to discharge its sewage.

The sewers of the north side were united, near Abbey Mills, in the east of London. At Grosvenor Road there are pumps which raise the sewage in the Low Level Sewer 16 feet, and thus enable it to continue its course by gravitation. At Abbey Mills it is again raised by the same means, so as to reach the same level as the contents of the other sewers.

The eight steam-engines at Abbey Mills have nominally 1,200 horse-power, and work sixteen pumps. The sewage traverses a filter, which retains the solid matters, and then enters a reservoir placed under the boiler-house. From this it is pumped into the sewers. Ventilating shafts pass from this reservoir under the furnaces of the engines, so as to destroy the sewer-gases, and obviate all offensive smell.

From Abbey Mills the united sewers run in a straight line above ground to Barking Creek, a distance of $5\frac{1}{2}$ miles, where they discharge into the Thames. Although united, they still form special canals, communicating with one another by movable sluices, so as to share the water equally and to preserve an equal rate of current.

From London Bridge (in the heart of London) to Barking Creek the distance is about 12½ miles along the river.

At flood-tide the sewage at the outfall is conveyed into an immense reservoir, 10 acres in area, and 16 feet deep. At ebb-tide the sewage in the reservoir and in the sewers is discharged into the river. The reservoir is divided into four parts by partitions. By means of a special pipe, at high-tide, Thames water can be introduced into each of these divisions to cleanse them. Overflow canals are provided in case of necessity. The reservoir is entirely under arches of masonry, covered with a thick layer of earth.

The sewers on the south of the Thames unite at Deptford, where there is a pumping station. This consists of four machines, having nominally 500 horse-power, and working eight pumps, which raise the water 18 feet.

From Deptford a single subterranean sewer of masonry, and having a circular section with a diameter of 12 feet, conducts the sewage a distance of 7½ miles on the south side of the Thames to Crossness, which is situated 1·86 miles beyond Barking. At Crossness there is a similar reservoir to the one at Barking Creek, but having a surface of only 6½ acres. The sewage is pumped into it, and is discharged into the river during ebb-tide. On the arches covering over this reservoir there are a large number of houses for the workpeople engaged at the sewage outfall. The air is quite pure, the sewer-gases having been passed through the furnace-fires.

As already stated (p. 109), notwithstanding these arrangements, the Thames has become seriously polluted, and the Metropolitan Board of Works attempted to remedy the evil. Since 1888 a chemical process has been applied to the sewage before its discharge into the river. This consists of a mixture of 0·013 grm. of sulphate of iron and 0·05 grm. of lime to every litre of sewage.[1] The deposited sludge is carried out to sea in barges and emptied into it.

This method has not proved satisfactory. Previously similar attempts had been made by the A, B, C method, so called because the chief materials used were alum, blood, and clay. 1,900 parts of clay, 600 of alum, and 1 of blood were mixed; some magnesia, manganate of potash, chloride of sodium, etc., being also used; but they had been abandoned on account of the bad results obtained.

The method of irrigation has also been tried for London. About 1860 a farm was started at Barking, near the northern outfall. This method was not, however, fully tested; the fear that infected matter might be transmitted by the vegetables cultivated on the farm preventing their sale, and necessitating the abandonment of the farm.

The quantity of sewage discharged daily at Barking and Crossness is about 1,320,600 gallons. After heavy rains the amount is considerably increased. There are special storm-outlets into the river at the pumping stations and at other points in the main sewers.

The sewers are ordinarily circular, with a diameter from 4 to 10 feet.

[1] More recently manganate of soda has been used with more favourable results.

They are generally of brick-work, set in concrete. Under roads and rivers iron sewers have been employed.

The dimensions are determined by the maximum amount of sewage to be discharged in a given time, and the rapidity of current required to prevent deposits. The rapidity is reduced as far as practicable, the most suitable being 2 feet per second.

The average daily amount of sewage for each person is reckoned at 31 gallons; as the population increases this quantity becomes about 25 per cent. more. The rain-water in the sewers is estimated at about three times the above quantity.

The smaller street-sewers are usually of glazed earthenware, from 8 to 18 inches in diameter. The larger sewers are of brick, and ovoid in form. Their dimensions are 2 feet by 3 feet and $2\frac{1}{2}$ by $3\frac{1}{2}$ feet.

The flushing of sewers is effected by damming up the water in a sewer, and then letting it suddenly escape, the current scouring away the deposits in the sewer. With this object, at fixed points, are sluices with an opening in the form of Λ, closed by a valve acting independently of the sluice. When this valve is opened, the water rushes out very rapidly, driving with it all deposits.

Whatever is not removed by these means, especially in the larger sewers, is cleansed by hand labour and taken away in carts.

The principal sewers of London act very well: for a population of four millions, only about 150 men are employed in cleansing the main sewers. In Paris, with a population of two millions, 800 men are employed, and yet not all the sewage enters the sewers.

The sewers are ventilated in the middle of the road by grids, usually placed 150 feet distant from each other. Where practicable, or when the grids are complained of, ventilating shafts carried above the roofs of houses have been erected.

The Wimbledon Sewage-Farm.—At the present time the sewage of London, after chemical treatment at the outfalls, is discharged into the Thames; but irrigation is employed at Wimbledon, a southern suburb of London, with a population of 25758 (1891). Here a farm of 72 acres has been irrigated since 1886.

The sewage is first subjected to chemical treatment in large reservoirs, where it is mixed with milk of lime (1 gramme of calcium hydrate to each litre of sewage), and afterwards with alum (0·75 gramme per litre). The precipitate is pressed in the form of cakes, containing 50 per cent. of water, and weighing one-fifth of the total mass. About 11,000 lbs. of similar cakes are produced each week and used as manure. The cost of compression amounts to 14*d.* per 1,000 lbs.

The sewage thus clarified is carried on to the fields, where rye-grass and mangolds are chiefly cultivated. Osiers have also been planted in a part of the farm.

The Croydon Sewage-Farm.—Croydon, situated 10 miles to the south of London, may be regarded as a suburb, being included in the limits of what is known as *Greater London.*

Here the sewage of about 106,000 persons is purified by intermittent filtration at the Beddington Farm, $2\frac{1}{2}$ miles west of the town, 24 acres being devoted to this purpose. The soil consists chiefly of alluvial gravel, with some clay. The farm is divided into plots, which are irrigated in turn. Each plot is, as a rule, used as a filtering bed for six days, and then allowed to rest for three days, modifications being introduced, according to the time. The sewage is filtered twice in different plots.

Before being conveyed to the plots, the sewage passes through a metallic web, and then through a bed of coke. Much solid matter is thus retained, and is subsequently pressed and sold. About 13 tons of compressed sludge are produced weekly; the price for this quantity being about a sovereign. In the field, grass, especially rye-grass, cabbages, and roots are cultivated. The effluent water from the farm is clear and colourless: it passes into a neighbouring stream.

CHAPTER V.

LONDON (*continued*).

RÉSUMÉ as to Measures against the Spread of Infectious Diseases.—Vaccination.—National Vaccine Establishment.—Isolation and Treatment of Infectious Patients.—Regulations for the removal of patients suffering from Infectious Disease, and for Visiting them.—Disinfection.—Mortuaries.—Burials.—Prostitution.—Public Buildings.—Hospitals.—Houses of Parliament.—Guildhall.—Prisons.—Workhouses and Asylums.—Houses for the Working Classes.—Résumé on Industrial Hygiene.—Over-fatigue.—Work of Children in Factories.—Work of Women in Factories.—Over-work and exceptions to the Law in force.—Factories.—Hygienic difficulties due to the nature of the work in Factories.—Accidents caused by work in Factories.—Food, Methods of Life and Dwellings of Workpeople.—Inspection of Factories.—Sanitary Provisions as to Industries.—Measures against Accidents.—School Instruction of Children employed in Factories.—Inspection of Factories.—Résumé of School Hygiene.—Site and Construction of Schools.—School Furniture.—Lighting of Schools.—Appliances for Teaching.—Hours for Class-work, Rest, Meals, and Exercise.—Preventive Measures against Illness.—The Supervision of School Hygiene.—Sanitary Regulations as to Schools.

Résumé as to Measures against the Spread of Infectious Diseases.—The general measures necessary to be taken against the spread of infectious diseases by the air, water and soil have been already indicated, so far as science has as yet indicated them. But although these measures may be expected to diminish the local conditions favouring such diseases as enteric fever and cholera, they are not effectual against the spread of such diseases as scarlet fever. For these it is necessary to adopt direct measures.

The important discovery of Jenner and the results obtained by Pasteur in making animals refractory to certain diseases by means of the inoculation of an attenuated virus, have given rise to the hope that in the future protective inoculations may protect against all infective diseases. Without discussing the probability of such an event, it is plain that at present we must trust to other measures.

These measures consist in the isolation of infectious patients, and the disinfection of all articles which have been exposed to infection, as well as of dejecta and discharges from the patient, so as to destroy the virus.

The English more than any other nation have realized the importance of isolation of infectious patients. Thus they have introduced into their legislation detailed regulations which oblige local authorities to take the necessary measures, and be in readiness for their execution (see pp. 30, 31, and 51–72).

For disinfection also the English regulations are the most detailed. The knowledge of the conditions of life of bacteria becoming each day more and more exact, a fixed system of disinfection has been impracticable. The methods adopted are steadily improving. The essential point is to use a method which will destroy the vitality of pathogenic microbes.

Microbes, like all other living organisms, are destroyed at the temperature of boiling water; but the spores of some of them have been shown to be refractory, a temperature

of 110° to 115° C. for two hours being required for their destruction, though the greater number are destroyed by exposure to boiling water at 100° C. for 50 or 60 minutes.

To disinfect infected clothing, steam has been shown to be more efficacious than dry heat. Bacteria without spores perish after an hour's exposure to a dry heat of 100°, at the end of five minutes in steam at the same temperature. The spores of some bacteria can withstand a dry heat of 110° C. for five hours, perishing at the end of three hours' exposure to 140°. With steam at 100° to 105° an exposure of 15 to 20 minutes kills them, and this applies to the spores of all known pathogenic microbes.

Dry heat does not penetrate the interior of bedding so well as steam. Steam disinfecting stoves are rapidly superseding those in which dry heat is used.

A 1-in-20 solution of carbolic acid and a 1-in-1,000 to 1-in-5,000 solution of perchloride of mercury destroys infection in linen. A solution of corrosive sublimate has also been used for washing the walls and floors of infected rooms. The plan ordinarily pursued is to fumigate the sick-room after the patient has left it with fumes of chlorine or sulphurous acid, the walls being subsequently stripped, the ceilings lime-washed, and the walls and floors thoroughly scrubbed and washed before the room is again used. Infected linen is placed in a disinfectant solution; and subsequently blankets, bedding, and articles of clothing that cannot be washed, are removed by the Sanitary Inspector to the official disinfecting station to be subjected to the action of steam under pressure.

As infection may be conveyed by corpses, it is necessary to take preventive measures (see pp. 32 and 72).

We have previously indicated the important *rôle* played by the soil in the development of pathogenic microbes; for this reason measures require to be taken to prevent cemeteries from becoming a sanitary danger. They should only be allowed at a certain distance from towns and houses. The soil should be porous and well drained, so that the subsoil water is below the level of the corpses. A grave should only be used again at the end of twenty-six years. (In Finland the interval fixed is twenty years; it ought to vary with the climate.) The grave should be six feet deep.

If these precautionary measures are taken, the organic matter of corpses becomes gradually nitrified. If the interval between different interments is too small, pathogenic microbes or their spores might still develop. For this reason, cremation, which has many advocates, has considerable importance from a sanitary aspect.

We have said that prostitution is the cancer of modern society. It would be erroneous, however, to suppose that it is only of modern origin. History speaks of prostitution among all the civilized nations of antiquity, as the Egyptians, Phœnicians, Babylonians, and Persians. The widespread character of this evil among the Greeks and Romans up to the middle ages is even better known. The number of attempts made to extirpate it is considerable; they all agree in imposing a punishment upon the offenders.

So long as syphilis was not very prevalent, prostitution could only be looked at from a moral standpoint; now it is a very complicated question. Although society has a perfect right to protect itself by preventive measures against the spread of syphilis, there is now a widespread feeling that such legislative measures involve the doing of evil that good may come.

This opinion is erroneous. The surveillance of persons dangerous to society and their examination, with a view of preventing the spread of contagion, is necessary in the interests of the community. The same sanitary measures are required for syphilis as for other contagious affections; viz., isolation of those affected, and disinfection of the infected parts of the body, with general anti-syphilic treatment.

The measures to combat syphilis hitherto taken have been insufficient. It would be absurd, however, for this reason to discontinue them; they ought rather to be extended. This is the domain of hygiene. How to effect the desired end is a problem presenting the greatest difficulties. Two measures at least ought to be insisted upon: a certificate of freedom from disease from suspected persons, and the isolation of diseased persons from the healthy.

Vaccination.—The regulations of the Vaccination Acts of 1867–74 are in force in London. The Local Government Board have charge of their execution.

In order to keep up a supply of lymph, the *National Vaccine Establishment* has been established in London, under the direction of the Local Government Board, and directed by two Vaccinators. There is an *animal vaccine establishment* for the vaccination of calves, from which the National Vaccine Establishment draws its lymph. At the animal vaccine establishment children are also vaccinated direct from the calf. The results are very satisfactory, negative results not amounting to 1 per cent.

The vaccination of infants is done every Tuesday and Thursday, from 10 to 11.30 a.m. from calves inoculated on the previous Thursday and Saturday. Two calves are inoculated at a time, about one hundred incisions being made in the belly of the animals, which have been previously examined by a veterinary surgeon. Until this examination has been made the animals are isolated in a special stall.

To collect the lymph, the following procedure is adopted: each pock is seized by a forceps, the vesicle is raised, and the lymph is drawn out by a capillary tube, or received on ivory points. The tubes are sealed with paraffin. The pulpous mass is scraped and placed between small glass plates. The lymph is not mixed with glycerine or other material.

The establishment contains a waiting-room and a vaccinating-room, behind which are three compartments for calves. Each of these is 153 square yards in dimensions, and contains four calves.

The floors are cemented; in the byres they slope towards a gutter communicating with the drain by a trap. The walls are brick, with an internal coating of cement up to 1·30 metre above the ground. The divisions of the stalls are of wood, the feeding-troughs of iron.

The establishment is heated by hot-water pipes arranged so that each room and stall can be heated independently.

There is also a yard, at the end of which are water-closets, an ashpit, and a byre for the isolation of calves before their inspection by a veterinary surgeon. There is a separate room for boiling milk intended for the food of the animals. To prevent all infection, strict precautions are taken as to the transport and feeding of the animals.

The lymph used in this establishment comes from natural cowpox lymph obtained in 1881 in a farm at the village of La Forêt, near Bordeaux.

Isolation and Treatment of Infectious Patients.—The English sanitary legislation shows that in Great Britain, great importance is attached to the preventive treatment of persons suffering from infectious disease.

In London the *Metropolitan Asylums Board* is the authority for superintending these requirements, the Metropolitan Poor Act of 1877–79 having conferred this power upon the Board.

The Board has established five hospitals for fever patients and one for convalescents. These are—

The Eastern Hospital at Homerton with 294 beds.
The North-Western Hospital at Hampstead with 210 beds.
The Western Hospital at Fulham with 230 beds.
The South-Western Hospital at Stockwell with 278 beds.
The South-Eastern Hospital at Deptford with 230 beds.
The Northern Convalescing Hospital at Winchmore Hill with 500 beds.

Up to the end of 1886, each of these five hospitals had a special division with fifty beds for smallpox patients. Now smallpox is only treated at Plaistow on the north bank of the Thames, outside London, in hospital ships, called the *Atlas*, *Castalia*, and *Endymion*, anchored at Long Reach; and at a convalescent hospital at Darenth in Kent, on the south side of the Thames.

Until 1881 the Board of Guardians of each district was charged with the transport of fever patients to the hospitals. This method did not work well, and the Asylums Board therefore undertook the organization and direction of this transport in a manner more convenient both for the patients and the public. The cost of this system is shared by the different districts, without regard to the number of patients removed from each district.

There are in London three ambulance stations, three wharfs on the Thames, and three steamboats for this service. Each station has a sufficient number of carriages, horses, and servants, so that removal can be carried out without interruption or delay.

At Long Reach is a fourth station on the wharf for the steamboats which convey patients to Darenth or convalescents back to London.

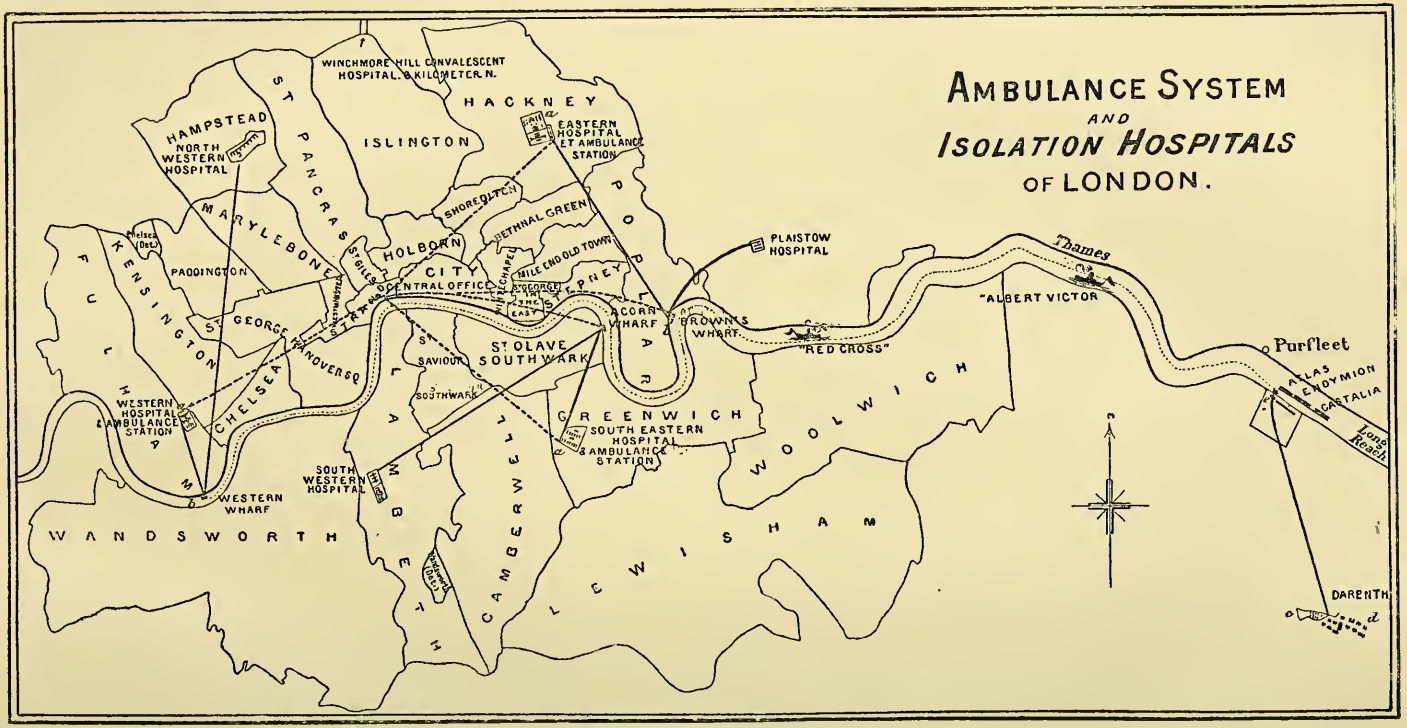
The ambulance stations are situated as follows: one at the Eastern Hospital, one at the Western Hospital, and the third at the South-Eastern Hospital (see plan, p. 150). These stations are independent of the buildings and the administration of the hospitals, being separated from them by a high wall. The repairs and cleansing of ambulances are done here.

There are in each station a fixed number of horses ready in case of need. These are hired from a contractor, who also furnishes others for additional payment. The contractor supplies forage, bedding, and servants; the administration furnishes the ambulances, harness, and uniform of the drivers.

Sixty ambulances have hitherto sufficed for the transport of patients to the hospitals. Special carriages are employed for the conveyance of convalescents to the convalescent hospitals, and for bringing patients back home.

The ambulances, for one or two horses, are roomy and well warmed and ventilated; the interior consists of varnished wood. The patient is placed on a litter furnished with india-rubber air-cushions and a sufficient amount of bedclothes.

An attendant accompanies each ambulance; if the patient is a male adult, the attendant sits outside. The ambulance is provided with a


AMBULANCE SYSTEM
AND
ISOLATION HOSPITALS
OF LONDON.
WINCHMORE HILL CONVALESCENT HOSPITAL. 8 KILOMETER N.
HAMPSTEAD
NORTH WESTERN HOSPITAL
ST PANCRAS
ISLINGTON
HACKNEY
EASTERN HOSPITAL ET AMBULANCE STATION
MARYLEBONE
SHOREDITCH
BETHNAL GREEN
POPLAR
PLAISTOW HOSPITAL
Thames
Chelsea Dock
PADDINGTON
HOLBORN
CITY
CENTRAL OFFICE
WHITECHAPEL
MILE END OLD TOWN
LIMEHOUSE
KENSINGTON
ST GEORGE HANOVER SQ
STRAND
ACORN WHARF
BROWN'S WHARF
"ALBERT VICTOR"
"RED CROSS"
Purfleet
ATLAS
ENDYMION
CASTALIA
Long Reach
FULHAM
CHELSEA
ST OLAVE SOUTHWARK
SAVIOUR
SOUTHWARK
GREENWICH
WOOLWICH
WESTERN HOSPITAL & AMBULANCE STATION
SOUTH EASTERN HOSPITAL & AMBULANCE STATION
SOUTH WESTERN HOSPITAL
WESTERN WHARF
WANDSWORTH
BERMONDSEY
CAMBERWELL
LEWISHAM
DARENTH

medicine chest containing remedies of which the attendant can make use if necessary.

The interior of the ambulance is disinfected immediately after arrival at the hospital or at the wharf where the patient is placed on a steam-boat. There are special ambulances restricted to the use of smallpox patients.

Friends and parents are not allowed to accompany the patient. The drivers are not allowed to stop *en route* on pain of dismissal.

The wharfs for embarkation are: the Western Wharf at Wandsworth, the Acorn Wharf at Rotherhithe, Brown's Wharf at Blackwall, and Long Reach for the hospital ships. The persons employed at these wharfs are in uniform.

The three ambulance steam-boats, *Red Cross*, *Maltese Cross*, and *Albert Victor*, are about 107 feet long by 16 feet wide, with a depth of 7 feet, and a draught of water of 4·7 feet. The fore-cabin forms "the hospital," and is divided into two parts. It will hold 16 patients seriously ill or 50 persons lightly affected or convalescent. The hind-cabin is arranged for patients after convalescence who are returning home.

The steam-boats are cleansed and disinfected from time to time, the bedding being washed in the laundries of the hospital ships.

A doctor and two attendants are on each ambulance vessel, provided with medicines and milk which are given as directed by the doctor. In the event of accidental delay by fog, the vessel is provided with beef-tea, tea, coffee, biscuits, etc.

All persons engaged in the ambulance-service are vaccinated; they wear uniform and live at the stations at the wharfs.

The central office of the Asylums Board is in Norfolk Street, Strand, near the Thames. It is in telephonic communication with all the stations. All requests for removal of patients are sent here; and all orders for their removal are sent from this office, stating whether by road or water, from their home or from the hospitals home.

If the Medical Officer of Health for a district thinks it advisable to send a patient to the hospital, he telegraphs to Norfolk Street the name, age, and address of the patient, and the nature and gravity of the disease. A telephonic message is at once sent on to the nearest ambulance station, and within five minutes an ambulance with an attendant is on its way to the patient. The patient is at once conveyed on a litter to the ambulance, the parents have given to them a printed notice stating the hospital to which the patient is being taken and an extract from the rules of the hospital.

The Medical Officer informs himself of the state of the patient soon after his admission, and sends a report to his parents. If the condition of the patient is dangerous, similar reports are sent daily until improvement occurs or the patient is dead. This is done to avoid visits to the hospital.

Smallpox patients are treated at the Plaistow hospital, the hospital ships, and at Darenth. The latter is usually only employed for convalescents, but may, if necessary, be used for slight cases.

The freedom from infection of patients is notified at Norfolk Street, where the necessary arrangements are made for their return.

The poor, before leaving the hospital, are provided with new clothing; the clothing of other patients is cleansed and disinfected by steam. Old clothing is immediately burnt in a crematorium provided at each hospital.

The convalescents from other diseases than smallpox are sent to Winchmore Hill, in the north of London, where they remain until quite recovered and free from infection.

Thanks to the system of convalescent hospitals, the Asylums Board Hospitals are able to undertake the treatment of a large number of patients; while the recovery of convalescents is hastened by their removal further from the town.

The general effect of the Asylums Board Hospitals has been most satisfactory, the number of infectious cases having been diminished by their establishment.

The Metropolitan Asylums Board has published the following set of regulations as to the removal of persons suffering from infectious diseases :—

1. *Apply on week days*, between 9 a.m. and 8 p.m., to the chief offices. Postal address: Norfolk House, Norfolk Street, Strand, W.C. Telegraphic address: Asylums Board, London. Telephone number, 2587. (*N.B.—Applications in the latter part of the day must be dispatched in time to reach the offices before* 8 *p.m.*) *At night* between 8 p.m. and 9 a.m., and on Sundays, Christmas Day, and Good Friday, to the Ambulance Stations: Eastern Ambulance Station, Brooksby's Walk, Homerton, N.E.; South-Eastern Ambulance Station, New Cross Road (near Old Kent Road Railway Station), S.E.; Western Ambulance Station, Seagrave Road, Fulham, S.W.
2. *Removal to the Board's hospitals :—*
   (*a*) Only persons suffering from smallpox, fevers, or diphtheria are admitted into the Board's hospitals.
   (*b*) Every application must state the name, age, and full address of the patient, from what disease suffering, and in cases of fever the particular kind of fever; and also the name of the person making the application.
   (*c*) Unless a medical certificate be handed to the ambulance nurse, the patient will not be removed.
   (*d*) Patients should leave all valuables, money, etc., and all outside clothing at home, should wear body linen only, and be wrapped in the blankets provided for the purpose.
   (*e*) The ambulance nurse will leave, at the house from which the patient is removed, a notice stating the hospital to which the patient is to be taken, and a copy of the regulations as to visiting, etc.
3. *Conveyance to other places :—*
   (*a*) Persons suffering from any dangerous infectious disease may be conveyed by ambulance to places other than the Board's hospitals.
   N.B.—Dangerous infectious diseases include the following: smallpox, cholera, diphtheria, membranous croup, erysipelas, scarlatina or scarlet fever, typhus, typhoid, enteric, relapsing, continued and puerperal fevers, and measles.
   (*b*) Every application for an ambulance must state :—
   (i.) Name, sex, and age of patient.
   (ii.) Description of disease, and, in the case of fever, the particular kind of fever.

(iii.) Full address *from* which the patient is to be conveyed.
(iv.) Full address *to* which the patient is to be conveyed.

(*c*) The patient must be provided with a medical certificate of the nature of the disease, to be handed to the driver of the ambulance.

(*d*) The charge for the hire of the ambulance, including (when the patient is over ten years of age) the services of a male attendant, is 5*s*. This amount must be paid to the driver, who will give an official receipt for the same.

(*e*) One person only will be allowed to accompany the patient, and such person may be conveyed back to the place from which the patient was conveyed. If desired, a nurse will be supplied at an additional charge of 2*s*. 6*d*. for her services.

(*f*) The ambulances may be sent outside the Metropolitan district only by special sanction of the Ambulance Committee or of the Clerk to the Board, and in such cases an extra charge will be made of 1*s*. for every mile outside the Metropolitan area.

4. The drivers of the Board's ambulances are not allowed to loiter on their journeys or to stop for refreshments on pain of instant dismissal. It is particularly requested that any breach of this regulation, or any neglect or incivility on the part of the drivers, nurses, or attendants may be immediately reported to the undersigned.

The servants of the Board are forbidden to accept any gratuities or refreshments.

Regulations as to furnishing information relative to the condition of patients, and as to the visiting of patients :—

Information as to condition of patients :—

2. Upon the admission of a patient, a letter will be sent to the nearest known relative or friend, setting forth the state of the patient. Should any serious change for the worse take place, a letter will be sent daily to the relative or friend, stating how the patient is progressing, which letter will be continued until the patient is in such a condition as to render further communications unnecessary ; but should the patient become dangerously ill, notice will be sent to the nearest known relative or intimate friend, with an intimation that the patient may be visited ; and, at the discretion of the Medical Superintendent, arrangements may be made for the conveyance of the visitor to and from the hospital.

3. Enquiries as to the condition of patients must be made in writing to the Medical Superintendent, who will reply by return of post. It is very undesirable that friends of patients should personally make enquiries at the hospital.

Visiting :—

4. The visiting of patients is limited to the nearest relatives and intimate friends of patients dangerously ill. One visit only will be allowed daily to each patient. Visits, which will *not* be *permitted without the permission* of the Medical Superintendent, are, as a rule, to be limited in duration to a quarter of an hour. In urgent and special cases, however, the Medical Superintendent is empowered to increase the number of visitors to two, and to extend the duration of the visit.

5. Visitors are warned that they run great risk in entering the hospitals. They are advised not to go into the wards of the smallpox hospitals without having been properly revaccinated, and if they reside where the case visited occurred, are earnestly requested to urge the remainder of the occupiers of such house to call at once on the Public Vaccinator (whose address can be obtained from any of the parish officers) for the purpose of being vaccinated.

6. Visitors are further advised not to enter the wards in any of the hospitals when in a weak state of health or in an exhausted condition, but to partake of a good meal before entering the hospitals. They will be required when in the wards to carefully avoid touching the patient, or exposing themselves to his breath, or to the emanations from his skin ; and will not be permitted to sit on the bed or handle

the bed-clothes, but will be allowed to sit on a chair by the bedside at some little distance from the patient.

7. Visitors will also be required to wear a wrapper (to be provided by the Board) to cover their dress when in the wards, and to wash their hands and faces with carbolic soap and water before leaving the hospital, or to use such other mode of disinfection as may be directed by the Medical Superintendent.
8. Visitors are strongly urged not to enter any omnibus, tram-car, or other public conveyance immediately after leaving the hospital.

Ambulance stations. Rules and regulations for the guidance of the female staff:—

The female staff must be up each morning and at their work at hours to be fixed from time to time by the Superintendent.

The staff will take their meals at such hours as may be fixed by the Superintendent, and approved by the Committee of Management. On no account is any article of food to be taken from the mess-room to the dormitories.

All officers on every occasion of going on leave, must have a bath and substitute their own clothing for their uniform before leaving the premises.

All officers on leave are to return punctually to the station. If any officer is late, the Superintendent may stop her leave on the next occasion, reporting thereon to the Committee at their next meeting.

In the case of an officer being absent without leave, a deduction will be made from her wages, and the matter reported to the Committee.

Any officer, in case of illness, shall apply to the Superintendent of the station for an order to see the Medical Superintendent of the adjoining hospital for treatment.

The women's leave and the cleaning of the dormitories will be regulated in detail by the housekeeper.

Any officer guilty of misconduct or insubordination will be liable to immediate suspension by the Superintendent, who will report the facts of such suspension to the Clerk forthwith, and to the Committee at their next meeting.

No officer is permitted to sleep in the dormitories during the day.

Officers must retire to their bedrooms by 10.0 p.m., and all lights must be out by 10.15 p.m.

No naked lights may be carried; and when matches are used, care must be taken that they are not thrown down whilst alight.

Disinfection.—The disinfection of ambulance carriages and steamers is done by washing with a solution of carbolic acid. The hospital linen is soaked in carbolic solution, and subsequently boiled and washed. In the new hospitals, clothing is disinfected in steam disinfecting chambers; in the old hospitals, by means of dry air at 110° C, the source of heat being steam-pipes.

In many of the sanitary districts of London, the disinfecting chamber is of an old type, though the number employing superheated steam is rapidly increasing. Arrangements are made in some districts for the temporary housing of persons who are obliged to leave their houses while they are being disinfected. As soon as a patient has been removed to the hospital, or if treated at home, as soon as he is certified to be free from infection, a disinfector calls to fumigate the infected rooms with chlorine or sulphurous acid. The rooms are subsequently ordered to be cleansed, the wall-paper stripped off and burnt, etc.

Mortuaries. Burials.—In accordance with the sanitary laws (p. 57)

each district of London is required to have a mortuary, to which can be taken the bodies of persons who have died of infectious diseases, whose retention at home involves danger to other members of the household.

Prostitution.—In England, prostitution is not regulated by law, although the dangers of the present state of things have been repeatedly pointed out by hygienists. The plans recommended have always met with opposition in Parliament, either on the ground that they interfere with personal liberty, or that they legalise vice.

The only legal restrictions on this plague of humanity are contained in the *Towns Clauses Act of* 1847. In accordance with this, the police may interfere if a prostitute accosts passers-by in the street, or causes any scandal in a street, restaurant, etc. The police have also power to take action if two ratepayers complain, on their own responsibility, after having given a caution.

Syphilis having become much more prevalent among soldiers (250 per 1,000 were attacked), prostitutes were subjected to inspection in fourteen garrison towns and ports by the *Contagious Diseases Acts*, 1864, 1868–69. The treatment of diseased women in hospital was made compulsory.

Although as the result of this measure the evil was considerably diminished among prostitutes and soldiers, a public agitation was kept up until in 1883 these Acts were revoked. The situation at present is as deplorable as before the passing of the Acts.

Moreover, in consequence of the facts that diseased persons are not obliged to undergo treatment in a hospital, syphilis shows itself in Great Britain in a much more severe form than on the Continent. In Brussels, these forms are known as *English syphilis*.

The Towns Police Act above mentioned is, however, applied with great severity in London. A large number of women are sent to prison for having caused scandal in the streets, while the keepers of houses proved to be disorderly are subject to heavy penalties.

Public Buildings. Hospitals.—All the new hospitals in London are erected on the system of separate pavilions. English hospitals differ materially from continental as to methods of heating and ventilation. The heating is effected chiefly by open fireplaces in which coal is burnt. The maintenance of a bright fire from morning to night during winter forms part of the comfort of English life, while at the same time it is an excellent help to ventilation.

In addition to open fireplaces, each pavilion in the larger hospitals has a system of hot water pipes, though these are only employed in the wards during very cold weather, when the open fireplaces do not give sufficient heat.

During recent years open fireplaces on the pattern of the Galton stove have come largely into use, thus ensuring that the fresh air is warmed before entering into the room. The wards of the Herbert Hospital are heated solely by this method.

The system of ventilation used in England has already been indicated ;

but we may add a detailed description of the installation in the Herbert Hospital, designed by Douglas Galton, on the principle of double pavilions (Fig. 3, p. 60).

The windows of each ward are opposite each other, and made to open top and bottom. At each corner of the ward is a pipe 35 centimètres by 35, going straight up to the roof, for the escape of vitiated air.

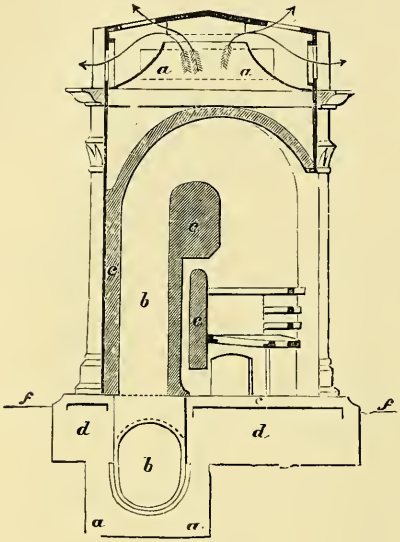


Fig. 49.

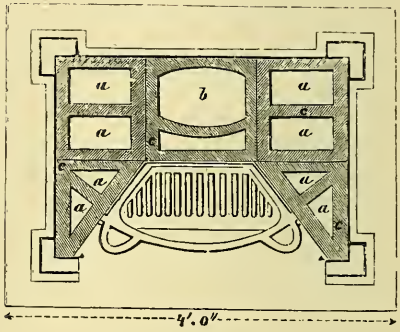


Fig. 50.

Galton's Stove.

Sheringham's ventilators are placed between the windows to supply fresh air when the latter are closed. In cold weather ventilation is accomplished chiefly by Galton's stoves (see p. 64), of which there are two in each ward at equal distances from each other and from the walls of the ward. Smoke escapes by the chimney *b*, which runs horizontally under the floor until the external wall is reached, when it passes upwards. Fresh air enters by the tubes *a* and *d*, which surround the shaft *b* (Fig. 50) under the floor. The air is thus already somewhat warmed when it reaches the hot part of the chimney *a a*, whence it enters the room.

The fire is contained in a box of bars of iron, lined by fire-bricks *c* at the bottom and sides. The entire fireplace is made of similar bricks, the smoke-flue *b* passing up its middle, and the fresh air tubes *a* at its sides. An opening at the back of the fire brings a current of air which increases combustion and prevents smoke. This air enters by *e*. The back of the fireplaces is arched, so that smoke escapes more easily by the shaft *b*. The floor-level is indicated by *f*. The width of the fireplace is 4 feet. The sectional area of the fresh-air inlet-tube is $6\frac{1}{2}$ square feet for each 95 cubic feet in the room. The horizontal smoke-flue is formed of a double iron tube, with a thin layer of clay between to prevent over-heating.

It has a sectional area of 74 square feet, and opens into a slightly larger shaft which passes upwards in the wall. The vertical length ought to be double the horizontal. The lower extremity ends at the ground-level to facilitate sweeping of the flue. The joints in both the horizontal and vertical parts are carefully rounded off to aid the escape of smoke. The horizontal flue is cleansed through an opening in the floor by means of a brush which pushes the soot into the vertical flue.

Near the ward-flues run the flues from the ground-floor, which maintain a certain amount of heat in the flues from the wards even when there are no fires in the wards, and thus help the escape of vitiated air.

The lavatories, water-closets, and ante-rooms (Fig. 5, p. 61), are heated by means of hot-water pipes.

The vitiated air is removed from the wards by means of exhaustion-shafts in the roof. Fresh air enters by openings in the walls behind the hot-water pipes, being thus warmed as it enters.

The staircases and corridors are heated and ventilated in part by means of a similar circulation of hot water.

In the celebrated *St. Thomas's Hospital*, the heating and ventilation are arranged on the same principles. The openings for the escape of vitiated air are at different heights in the walls; they communicate with pipes which join and open into great exhaustion-shafts. These are heated by the chimney-shaft, and by reservoirs of hot water placed in the attics, thus increasing the up-draught.

In the floating small-pox hospital *Castalia*, which is anchored near Long Reach, on the Thames, along with the ships *Atlas* and *Endymion*, the ventilating arrangements are peculiar, and require a special description.

The *Castalia* consists of two equal twin parts, under a single deck. It was built for channel work, and its double structure was intended to obviate the rolling of the sea, and thus prevent sea-sickness. Not fully realizing expectations, it was sold to the Metropolitan Asylums Board, who have made of it a small-pox hospital.

For its new purposes, five pavilions were constructed on the deck, parallel to each other, and separated by a space of 12 feet. The pavilions are 52 feet long, the front and back pavilions being 26 feet wide, those in the middle 10 feet wide. All the pavilions communicate by lobbies. At the two ends of the ship are two further pavilions, serving as bath-rooms, lavatories, water-closets, and isolation-rooms.

The ventilating arrangements have been arranged by Messrs. Boyle & Son. The vitiated air escapes by vertical iron shafts, varying in diameter from $2\frac{1}{2}$ feet to 4 feet. Each of these terminates above in an air-pump ventilator (see Figs. 24, 25 and 26, p. 99), 6 feet in diameter. The two large pavilions have each three of these; the small pavilions only two.

In each space between the pavilions are two ventilators for the lower deck.

The bath-rooms, water-closets, and isolated wards, are ventilated by sixteen similar ventilators, each 3 feet in diameter.

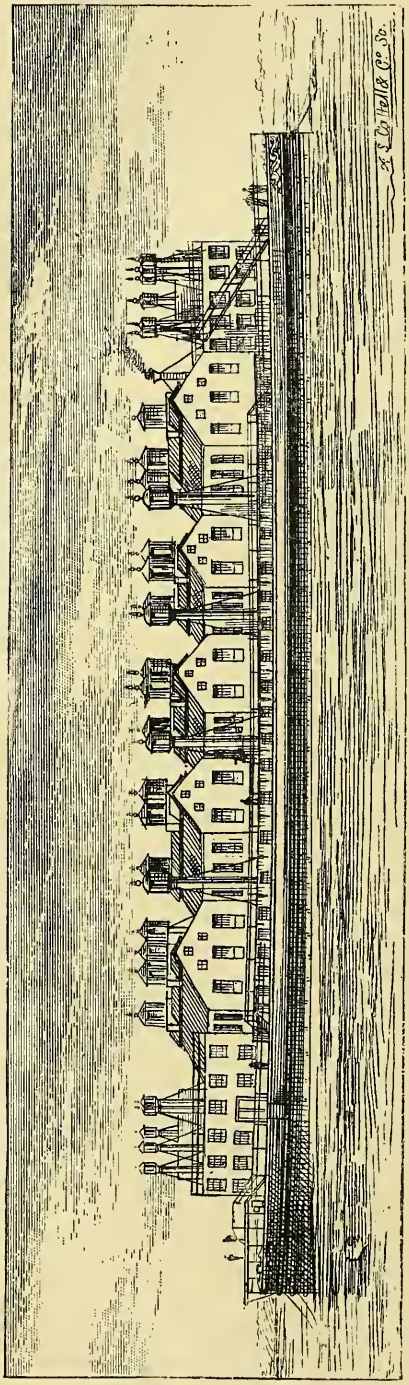


FIG. 51.—HOSPITAL SHIP "CASTALIA," SHOWING THE SYSTEM OF VENTILATION.

The openings for fresh air are placed near the floor, on all the walls. The entering air passes across hot-water pipes placed in the wainscoting, and running along the interior of the walls. The current of air is regulated by means of registers or valves, which can be opened or closed by screws.

Experiments made with great care show that the amount of air renewed by these ventilators amounts to 460,000 cubic feet per hour, without producing any unpleasant currents of air. The air of the wards is changed every five minutes by a similar ventilation. Down draught has not been found to occur.

The *Castalia* is capable of accommodating 150 patients.

The hospitals are lit by gas. Each gas-jet has over it a pipe which conveys the products of combustion and a considerable part of the vitiated air of the room directly into the external air. This tube is wide and funnel-shaped over the flame. In some hospitals the lamp is not enclosed; in others, as at the *Homerton Fever Hospital*, the lamp is completely closed, except for small openings below for the admission of air to the lamp.

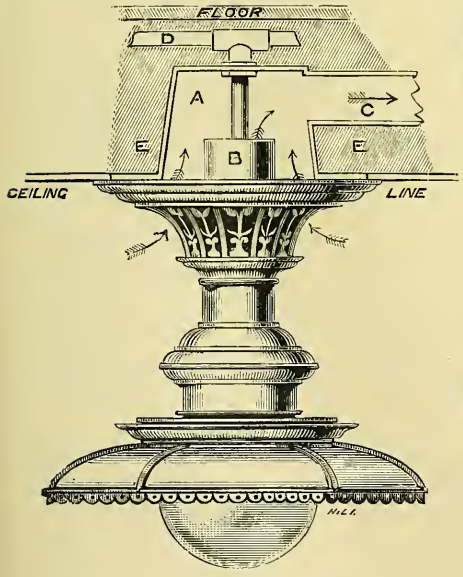


FIG. 52.
BOYLE'S VENTILATING GAS-LAMP.

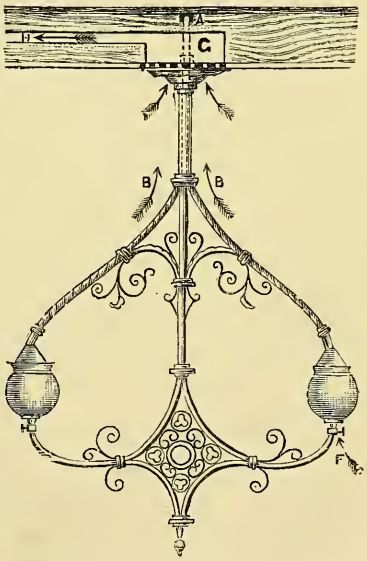


FIG. 53.
WENHAM'S VENTILATING GAS-LAMP.

These lamps diminish the heat from the combustion of gas at the same time as they allow the products of combustion to escape. The same objects have been secured by using a double tube in connection with lamps. Fig. 52 represents Boyle's lamp on this system. The air reaches the flame at F, the vitiated air from the room is discharged at G, while the products of combustion escape by the tubes B.

The Wenham gas-lamps are shown in Fig. 53 and 54. An iron wire-work A is fixed between the rafters of the room; the products of combustion enter it by the tube B. D is the gas-pipe, C is a tube opening into the chimney; at its junction with the chimney is a valve to prevent smoke from entering the room owing to down-draught, E is a quantity of non-conducting material, such as asbestos or some similar substance.

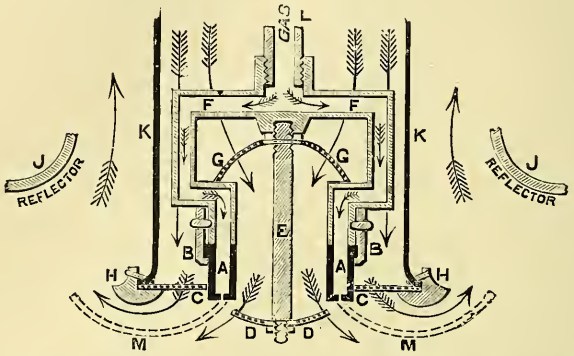


FIG. 54.—SECTION OF A WENHAM'S VENTILATING GAS-LAMP.

Fig. 54 shows a section of the same lamp. The gas descends by F to the burner A, meeting at C and D a double current of air which renders combustion more complete and the light more intense. B is a ring which retains the burner A in its place, H is another ring made to open and shut, and thus regulate the pressure of the burner at the point D.

At each hospital there is a disinfecting station. Many hospitals, especially those for smallpox, possess also a place for burning *débris* from the kitchen-sweepings, and old clothing of patients.

Houses of Parliament.—Air is admitted into the House of Commons through an underground room, in which it is warmed by contact with steam-pipes. To increase their heating power, these are provided with flanges at intervals.

The number of persons in the House being very variable, it is necessary to have means of regulating the heat supplied. This is done by covering with wool a larger or smaller number of the pipes, the result being checked by the thermometer.

Air enters from an asphalted yard, so as to ensure its purity. When heated, it ascends in four shafts about $3\frac{1}{4}$ feet in diameter, opening under the floor of the house, into which it escapes through gratings.

The ceiling is of glass, with openings for the escape of vitiated air (Fig. 55), which convey it into the shaft D, and thence to the up-shaft C. A fire at the bottom of this up-shaft increases the draught.

Direct experiments have shown that 1,412,000 cubic feet of air escape by this shaft hourly. If the house was completely filled, this allows 460 cubic feet of air per hour for each person. The lighting is by means

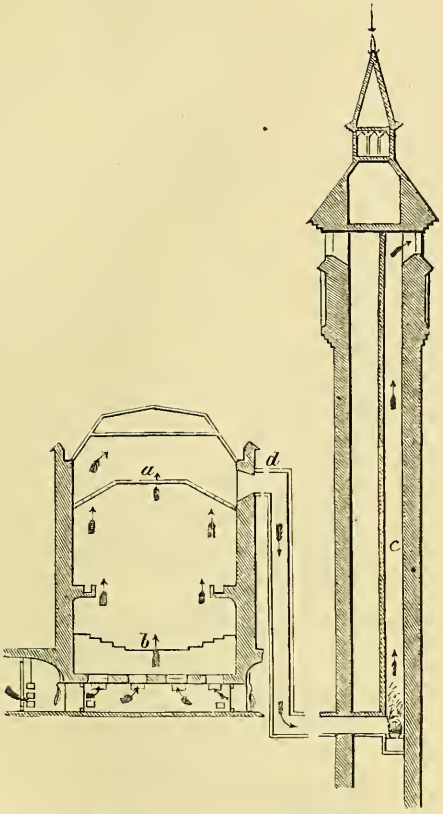


FIG. 55.—SECTION OF THE VENTILATING ARRANGEMENTS OF THE HOUSE OF COMMONS (AFTER DOUGLAS GALTON).

a. Glass roof perforated. *b*. Floor perforated in form of steps. *c*. Shaft for escape of foul air into the clock-tower. *d*. Shaft near the wall for conveying the foul air to *c*.

of gas-burners placed above the glass roof, but the electric light has also been installed.

Guildhall.—At the Guildhall is the hall in which the Court of Common Council of the City meets. Its ventilation has been arranged by Messrs. Boyle & Son as follows:—The impure air is carried off by nine iron shafts, extending from the ceiling to the roof, above which they each end in an air-pump ventilator (see Figs. 24–26, p. 99). Four of the shafts, two from each side of the hall, have a diameter of one foot. Each of these, a little above the ceiling, divides into two tubes 10 inches in diameter, connected with openings 18 inches wide made in the ceiling on its lower side, and concealed by ornaments in the form of a rosette. At the end of each shaft is a cowl 18 inches in diameter.

At the end of the hall, on its east side, is a shaft 16 inches in diameter,

with a cowl 30 inches wide. At the ceiling this is increased to 26 inches, with an opening of equal size in the ceiling.

On the west side is a shaft 20 inches in diameter, connected with an opening in the ceiling 30 inches wide, and having a cowl 35 inches in diameter.

At the middle of the dome, above the gas, is an opening into a shaft 16 inches wide. It is connected to the shaft 20 inches wide, of which we have just spoken.

From the dome also issue three other shafts 13 inches wide, and furnished with a cowl 20 inches wide.

Pure air enters by sixteen rectangular tubes, the dimensions of which are 18 by 35 inches, and 16 by 18 inches. These are in direct communication with the exterior by apertures in the walls, protected by an iron grating, and open into the room at various levels above the floor. Each tube is furnished with a special heating arrangement, to warm the in-coming air in the cold season. This arrangement is shown in Fig. 56.

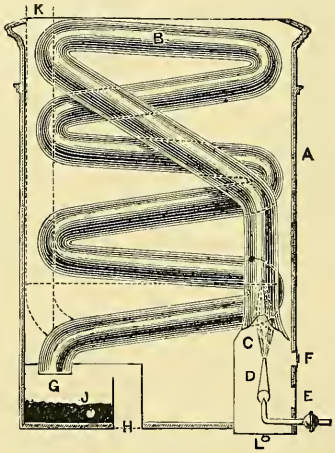


FIG. 56.—APPARATUS FOR WARMING IN-COMING AIR, IN USE AT GUILDHALL.

The ventilating tube A encloses a Bunsen-burner D in a metallic box C. At E is an opening of perforated zinc for admitting air to the burner. The gas is lit by the opening F, which a valve closes. The box C is connected with a tube B 4 centimetres in diameter, and curved as shown in the figure. It opens into a box G in which the moisture of combustion is condensed, while the air escapes by the opening H, and the condensed aqueous vapour escapes hy the tube J. The dotted line K indicates another arrangement of the pipe B. The box C has a movable bottom L for cleansing it.

The burner being lit, heats the air circulating in the tube B; this in its turn heats the air of the tube A.

With this apparatus the air in the tube A can be heated to 40° C. The temperature is regulated by adjusting the size of the Bunsen flame.

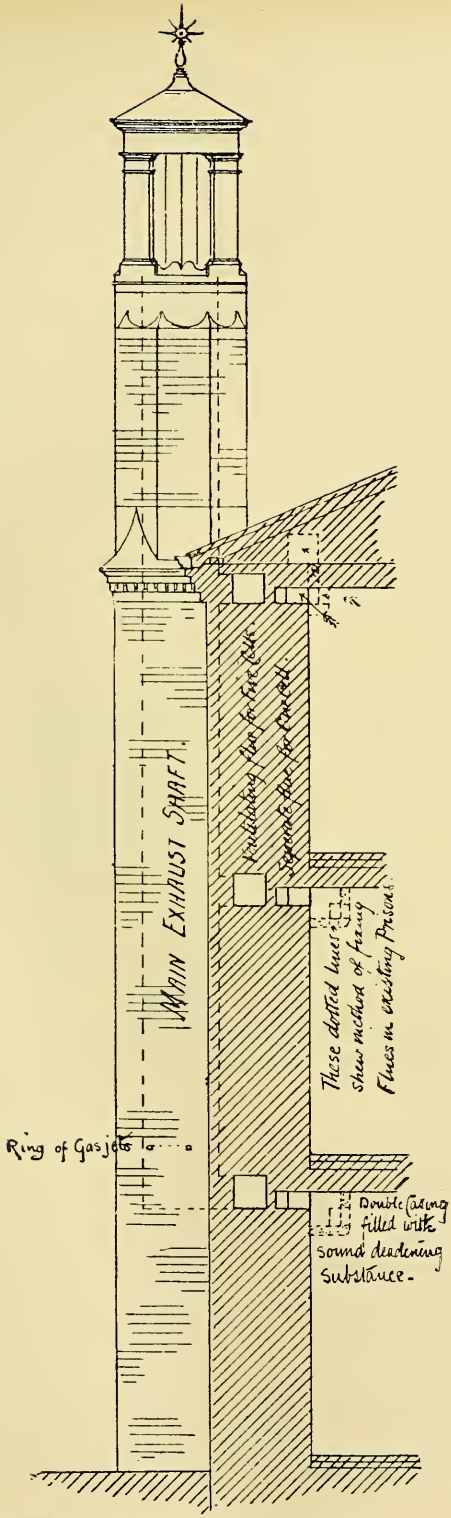


FIG. 57.—SCHEME OF VENTILATION OF A PRISON (BOYLE'S SYSTEM).

By means of this system of ventilation, 464,688 cubic feet of pure air are admitted hourly, without the production of unpleasant draughts.

Prisons.—As it is necessary to keep the cells in a prison completely isolated from one another, the ventilation of prisons presents many difficulties. The method proposed by Messrs. Boyle & Son is as follows (Fig. 57).

Suppose it is required to ventilate one wing of a prison containing three rows of thirty cells on each side, altogether 180 cells.

Three quadrilateral brick chimneys, each 3 feet wide, are placed at equal distances from one another, alongside one wall of the prison. They end above the roof in an air-pump ventilator $4\frac{1}{2}$ feet in diameter. In Fig. 57 one of these chimneys is shown under the name of *main exhaust-shaft.* Below the ceiling near the wall or in it, are horizontal tubes on each storey. In Fig. 57 one of these seen in the section of the wall is called the

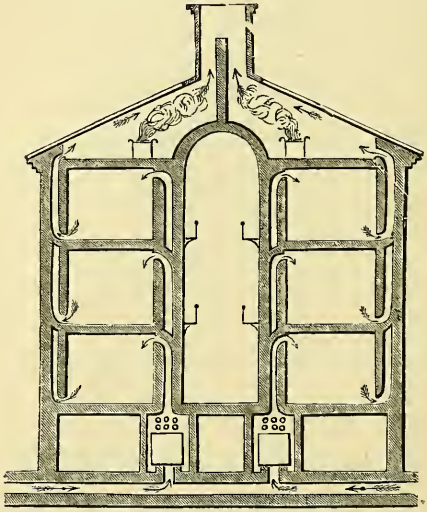


Fig. 58.—Scheme of Ventilation of a Prison (Jebb's System).

ventilating flue for five cells. Each of these horizontal tubes is connected with ten cells by a separate flue for each cell, of varying size according to the distance between them and the passage into the chimney. The size is such that the amount of air removed is the same in each cell. Three of these tubes, one on each storey, communicate with a chimney. The diameter of the horizontal tubes varies according to the distance between them and the top of the chimney, so as to ensure an equal draught on each floor for the cells. A ring of gas-jets (Fig. 57) fixed at the bottom of the chimneys heats the air in them and helps the up-draught.

There are no valves or other apparatus which render it possible for the ventilation to be interrupted in consequence of negligence.

The pure air entering from the corridor, is conducted into each cell by

means of vertical tubes in the walls, protected at each end by iron gratings. Fresh air is admitted into the corridors by two large openings at its ends. In winter the fresh air is admitted over hot-water pipes.

Another system employed in prisons was invented by Joshua Webb (Fig. 58). In this system, the openings for entry of air are placed under the ceiling. Impure air escapes by openings at the floor level.

This method of ventilation was first proposed by the celebrated French engineer, General Morin, its object being to maintain a uniform temperature in a hall during winter. To attain this object, and yet have efficient ventilation, it is necessary that the current of air in the extraction-shaft should be sufficiently strong. If this current becomes retarded, the ventilation becomes insignificant.

To avoid the necessity of heating the air in the extraction-shaft during the cold season, the connection between them and each room has been recently protected by openings with valves, one at the top of the room, and another at the floor level. In summer impure air escapes at the former; in winter, at the latter.

Inasmuch as in this system the air is forced in a direction contrary to that dictated by the laws of physics, a completely satisfactory result is almost impossible.

In the ventilation of prisons, it is necessary to take care that the exit-shaft for vitiated air from each cell is of sufficient length before opening into the common chimney, so as to avoid return of the air. If it opens directly into the common chimney for all the cells, it may easily happen that the vitiated air passes from one cell to another.

Workhouses and Asylums.—The following system of ventilation for asylums and houses of correction has been designed by Messrs. Boyle & Son, a continuous change of air being ensured for each room without any draught. This is very important, as the phantom fear of chills is still so great, that if the least draught is felt the tendency is to close all apertures.

The air-pump ventilator A (Fig. 59), 15 inches in diameter, is placed at the upper end of the shaft B, which is $7\frac{1}{4}$ inches in diameter. It is divided in its centre by a plate, so that the two currents in the branch shafts do not impede the exit of air. The branch shafts C are 5 inches in diameter, and are connected to tubes E placed in the walls, and having a diameter of $4\frac{1}{2}$ inches. In the upper storeys there are also shafts D, 4 inches in diameter, communicating with openings in the ceilings and joining the branches C. Tubes P between the ceilings and floors open into the tubes E, and serve for the exit of vitiated air by openings in the ceiling 5 inches in diameter. Pure air enters the rooms by the openings G, constructed as shown in Figures 29 and 30, p. 103. They are placed in a corner of the room as far as possible from the exit openings, and about 6 feet above the floor. Each of these openings is 10 inches long, and 5 by 3 inches across.

This system of ventilation has also been successfully employed for private houses and workshops. It is remarkable for its simplicity and

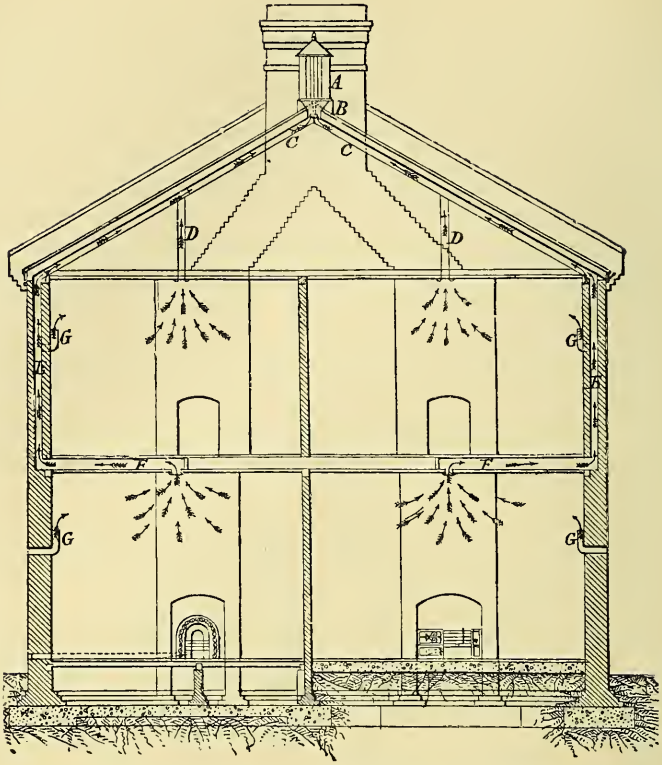


FIG. 59.—SCHEME OF THE VENTILATION OF A WORKHOUSE.

efficiency, and for the ease with which each room can be ventilated independently of others.

Houses for the Working Classes.—Since the importance of sanitary organisation has been fully realized, the question of the housing of the poor has occupied much of the attention of hygienists. Much disease is caused by uncleanliness of houses, and obstruction to the entry of air and light.

This question has also been made the subject of sanitary legislation. The Housing of the Working Classes Act, 1890 (page 42) makes it the duty of the medical officer of health to make a representation to the local authority of any houses or areas which are insanitary and unfit for human habitation, with a view to securing their closure, and if necessary, their demolition.

Common lodging-houses in London are under the supervision of the police, though it is hoped that their control will shortly be transferred to the London County Council. In other parts of this country the Local Authority already exercises control over Common Lodging-Houses. These houses are required to be registered, and inspection is made to ensure orderliness, cleanliness, ventilation, water supply, proper number of inmates, etc. The minimum cubic space for each occupant is specified, and the keeper is required to give immediate information to the local authority of any cases of infectious disease occurring in the house.

It is obvious, however, that all these measures, although important, are only palliatives, when there are structural defects of the buildings themselves.

Regulations for houses occupied by more than one family (page 28) may also be adopted by Local Authorities.

The most important matter is, however, to ensure that all new houses shall be of a hygienic type. This is ensured by a proper code of building bye-laws, strictly enforced. These bye-laws insist that plans of all new buildings shall be submitted to the local authority for their approval; that a sufficient open space shall be retained about each house; that proper measures shall be taken to ensure dryness and efficient drainage of the house; that there shall be proper openings for ventilation; that water-closet accommodation and a dustbin shall be provided. These regulations are necessarily more difficult to carry out in block dwellings than in cottages, though in both the importance of sufficient air-space and a proper angle of incidence of light to every room is very great.

London, in addition to being the most populous town in the world, is also the foremost industrial town. The question of houses for the working-classes is here, therefore, exceptionally difficult.

In the chapter on Sanitary Legislation it has been seen with what energy attempts have been made to improve the present state of things, with the result that each year the conditions of housing of the poor in London are improving.

This result is being obtained, not only by pulling down dilapidated quarters, widening streets, and building healthy tenements in the old quarters, but also by the improvements in communications having rendered possible the construction of vast colonies of workmen's cottages in distant suburbs.

Certain industries, as in all great towns, are in London localized in certain districts. The district north of the Thames, *Long Shore*, to the east of the city, is occupied chiefly by dockyards, stores, and manufactories, and is inhabited by seamen, carpenters, and mechanics.

Whitechapel, nearer to the east side of the city, contains, above all, the refineries of sugar, and a great part of its workmen are Germans.

In *Bethnal Green*, *Spitalfields*, and *Shoreditch*, to the north of Whitechapel, the spinning of silk is a prominent industry, the workers in this industry being, to a large extent, the descendants of French Protestants, who came to England after the revocation of the Edict of Nantes in 1685.

In *Clerkenwell*, between Islington and Hatton Garden, are found chiefly watch-making and metallurgic establishments and their workpeople. *Houndsditch* and *Leadenhall Street* are Jewish quarters.

On the south side of the river, in *Southwark* and *Lambeth*, are moulding, pottery, and glassware works, manufactories and breweries. In *Bermondsey* are tanneries.

The mortality in these districts is very variable. In 1891 it was, in Whitechapel, 32·65 per 1,000; in Kensington, only 21·81 per 1,000 in a year in which influenza was prevalent. Among the chief causes of this difference in death-rates are undoubtedly the conditions of housing and social status.

In most of the houses water-taps are placed in the house; in others only in the yards. The water-rate forms a definite percentage of the rental, and is paid by the owner; the occupier is thus secure of an unlimited supply of water.

The water-closets are generally in out-buildings in the back-yard, as are also the dust-bins. The best form of dust-bin is of galvanized iron furnished with a lid, and remote from the house.

Houses for the working-classes in London come under three categories: (1) Those built and let out by private persons; (2) those built by the municipality; and (3) those built by funds left for this purpose. The greatest legacy for this purpose was left by the American, George Peabody, amounting to £150,000. These funds have been expended in building block-dwellings, let out in one to three-roomed tenements. Their sanitary condition is very good, and they are much sought after.

Lady Burdett Coutts and other philanthropists have also devoted large sums to the building of houses for the poor.

A large number of associations have also been formed chiefly for building artisans' block dwellings, the most important being, *the Metropolitan Association for Improving the Dwellings of the Industrial Classes; Society for Improving the Conditions of the Labouring Classes; the Improved Industrial Dwellings Company; the Marylebone Association, and Prince Albert Cottages.*

The statistics for these block-dwellings are of a very favourable character, the death-rate in the Peabody Buildings for the four years 1886–89 being 18·79, as compared with 19·11 per 1,000 for the whole of London.[1]

The construction of houses for the poor varies greatly. Many old houses are let out into tenements sometimes consisting of only single rooms; in others each floor forms a separate tenement. Cottages occupied by only one family are built in suburbs where land is not so dear.

In the Peabody block-dwellings the walls are colour-washed, papering the walls being forbidden. In the Prince Albert Cottages there are shafts in the walls for the escape of vitiated air, pure air entering in the cold season across a chimney arranged on the same principle as that of Galton.

Résumé on Industrial Hygiene.—The sanitary dangers resulting from work in manufactories are universally recognised, and their prevention constitutes an important branch of industrial hygiene. As industry has become developed, so government has been obliged to adopt legislative proceedings to protect the workmen against the dangers to health involved in it.

There is as yet no uniformity in such legislation in different countries. The country possessing the most complete organization in this respect is undoubtedly England, though Switzerland and Austria also distinguish themselves in this subject.

The following are the chief dangers to health to which workpeople are often exposed:

1. Those caused by over-fatigue;
2. Those arising from defective conditions of the workshops;
3. Those arising from the work itself (dust, gases, poisons, etc.);
4. Those caused by the machinery (explosions, etc.);
5. Those connected with the worker (food, lodging, method of life).

Over-fatigue.—This is due to too prolonged work, curtailed rest, work at night or work involving a constrained position of the body, or only a partial activity, over-fatiguing a certain set of muscles.

[1] See a paper by Dr. A. Newsholme on "The Vital Statistics of Peabody Buildings" (Royal Statistical Society's Journal, 1891).

There are no general legislative enactments as to the hours of work for men over eighteen years of age. It has been supposed that this could be arranged voluntarily between masters and men, though experience has shown that the latter are helpless.

The results of too prolonged work are: diminished resistance against disease, inertia, indifference, moral defects, drunkenness, premature senility. Experience has also shown that with too prolonged work, the number of accidents increases in consequence of the diminished attention and the enfeebled elasticity of the muscles.

Since it is to the interest of the State that all classes should preserve their health and energy so as to be useful members of society, and not dependent upon it, the making of laws regulating the maximum hours of labour seems justifiable. In Switzerland and Austria such laws exist, the day's labour being limited to eleven hours. In these countries, manufacturers maintain that they have not lost by this limitation. The intervals for rest should be at least an hour at each time.

Night work should be prohibited, the consequences being the same as those of excessive work during the day. It is also proved that night work is inferior to day work, both in quality and quantity. The number of industries where technical reasons render night work necessary is so small, that a prohibitive law would not be difficult to enforce. In Switzerland such a law is contemplated.

The old methods of manufacture, involving fatiguing and unnatural positions or excessive muscular exertion, ought to be replaced by better methods.

Industry, feverishly active, has also encroached on the Sunday's rest. This should not be tolerated. English industry has never been guilty of this offence, and has thus proved that industry does not suffer from this weekly rest. It is only the masters greedy for gain, who in order to mask their cupidity, make any pretence to the contrary.

The old Divine commandment that the seventh day should be a day of repose, embodies a truth so in accord with the laws of health, that the guardians of religion may always depend upon hygienists for support in this matter.

Morality and religion are insisted upon; but at the same time the worker is obliged to compromise with his conscience: the value of order, propriety and the domestic life are emphasised, without the workman having a single day to devote to his family!

Work of Children in Factories.—Work in factories involving many dangers to the health of adults, it is evident that children would suffer even more. The work only putting into action a certain number of muscles, the balance of physical development is disturbed, a round-shouldered and narrow-chested condition being a common result. Diseases of the eye are two-and-a-half times as common among these children as among others of the same age. Premature work in factories is also the cause of a number of chronic maladies of the respiratory and digestive organs. For these reasons the employment of children in factories has been regulated in all countries by special enactments. The minimum age given in these enactments varies greatly. In France it is permitted, with certain restrictions, for children to work in factories from the age of 10 years. In England the legal limit has now been raised to 11 years. Germany and Austria make the limit at 12 years; in Switzerland the minimum is 14 years.

In the countries which permit the employment of children under 14 years, the day is limited by law: in England it is 6 hours for children from 11 to 14 years old, and 10 hours for children 14 to 18 years; in France children under 12 years are allowed 6 hours' work daily, and those from 12 to 16 years, 12 hours'; in Germany the daily limit is 6 hours from 12 to 14 years, and 10 hours from 14 to 16 years. In Austria children from 12 to 14 years work 8 hours, above 14 years, 11 hours a day. In Switzerland, in which only children over 14 years old can be admitted to factories, the duration of a day's work is the same as for adults, *i.e.* 11 hours. In some countries there are enactments as to the hours of rest to be allowed to children during the day's work.

In addition to the duration of work being reduced for children, night work, and work in certain industries, is in all countries prohibited for children.

Children are not allowed to spend their free time as they like; in England and in Germany, between 12 and 14 years of age, 3 hours daily must be occupied in school

attendance ; in France, 2 hours. In Switzerland children at 14 years of age have not completed their instruction, and are obliged to continue it after entering the factory, but then the school hours are included in the 11 hours day's work. Experience has shown that factory children, being already fatigued by their work, do not receive their school instruction to advantage. It ought always to be required that the school attendance should as far as practicable, precede the factory work.

Work of Women in Factories.—Experience has shown that the female organization is more prone to suffer from the pernicious effects of factory work than that of man. According to observations made in Switzerland, where exact statistics are available on this point, the cases of illness among men and women, where both work together, are as 100 to 127. The number of days of illness is 150 for women, compared with 100 for men. The mean duration of the illnesses as 117 for women and 100 for men (Schuler). If one compares in this respect the two sexes at ages under 18, the proportionate cases of illness are as 170 to 100 in all factories: in cotton-spinning factories 156 to 100.

Here is the most convincing proof of the necessity of taking legislative measures for protecting women in various industries.

It has been proposed to admit no female into a factory under 18 years of age, and to exclude also all married women. But necessity knows no law. Many industries also cannot continue without the help of female work. In Switzerland one-fourth of the persons employed in factories are females under 18 ; their removal would be equivalent, according to Schuler, to a diminution of 12 francs per person in the income of the population.

Temporary work, which only recurs at certain seasons, would be impossible without an occasional increase of strength, furnished chiefly by women occupied in ordinary times in their domestic work.

Legislation relative to women's work in factories ought to be like that for children ; *i.e., the reduction of the duration of the day's work, the absolute prohibition of night work, and the complete interdiction of certain industries.*

A reduction of the hours of work is necessary for women, not only in order to avoid excessive fatigue, but chiefly in order to allow time for the discharge of domestic duties.

In accordance with the English law, women and children should be freed from all work on Staurday at noon, an enactment which all countries would do well to copy. In addition, each married woman should have an extra half-hour at dinner-time, in order to prepare it, in addition to the time given to her husband.

In reducing the length of the day's work for women, England and Switzerland have both outstripped other countries, in most of which everything remains to be done in this matter. Night work is more generally prohibited for women, viz. in England, Switzerland and Austria. In France night work is only forbidden for women under 21, and in Germany there is no statute on the subject.

Special restrictions are necessary to protect pregnant women, and women after confinement, as statistical evidence shows an enormous number of mis-carriages and still-births. Thus, while in the whole of Switzerland there were 3·9 still-births to every 100 total births, the number among factory women was 8·2 per cent.

The mortality is greater among the infants under one year of age of women resuming their work a short time after accouchement than among infants of other classes of people. In the canton of Glaris, this mortality was 20 per cent. ; since the law of 1864 forbidding the employment of women until six months after their accouchement, the mortality of the infants of these women has not exceeded the average for the whole of Switzerland (Schuler).

Too early work after confinement produces disorders in the abdominal region. Certain industries, such as the making of printed calicoes and cotton weaving, have a specially deleterious influence on the health of women.

It is easy to prevent by enactments the too early employment in factories of women after accouchement, but it is difficult to provide enactments which will prevent pregnant

women from overworking. Pregnancy is only obvious at an advanced stage. Experience shows that women about to become mothers, for this very reason, work with more zeal than before. Switzerland is the only country which has a law forbidding women to work during the five months preceding accouchement ; and this law has been illusory, as women conceal the period of pregnancy, or do even more arduous work elsewhere than in the factory. Legislation should confine itself therefore to forbidding pregnant women to work in factories where the nature of the work, either from poisonous fumes or from mechanical inconveniences, is such as to compromise health, and to enacting that no pregnant woman can, contrary to her wish, be compelled to do such work.

Overwork and Exceptions to the Law in Force.—In many industries, exceptional times occur, in which overwork is required from the workers. To avoid abuses, special and precise regulations have been made.

It goes without saying, that such exceptional work should only be permitted on the strength of a special authorization, which in cases of necessity should be able to be given by the nearest authority. If the extra work is required for more than a few days, as for one or several months, the consent of the superior authority is necessary.

The following are regarded as sufficient reasons for such extra work : accidents, and disasters produced by natural causes, the lack of water, the fear of deterioration of articles (as in the preparation of preserved fish), seasonal work, etc.

Factories.—The hygiene of factories necessarily involves that the plans of the buildings should be first submitted to the local Sanitary Authority. In towns, it is a rule to examine all such buildings as to solidity and to provisions against the spread of fires.

The site should be healthy. The rooms should be well-lit, and must therefore be of a convenient size. The windows should be high, and reach nearly to the roof, so that the best light is admitted. In the section on school hygiene, will be found detailed indications as to the lighting of schools, which are equally applicable to factories. For the latter it is sometimes difficult to give precise rules, as the light depends much on the situation. It is necessary therefore to consider, in each case, whether the building is in an open position or in a narrow street with high houses, whether the walls are white or sombre in colour, and if there are columns or machines casting a shadow on the place where work is to be done. Lately the electric light has been used in establishments where sufficient motor power for its production is available. In such cases the light should be encased within ground glass, to prevent dazzling. Even with other forms of light it may be necessary to prevent too bright a light by covering the glass with whiting, or by using sky-lights, etc. The corridors, staircases and water-closets should be lit.

When steam-engines are employed as a motor power, workshops are best warmed by steam-pipes. The pipes should be so placed as to obviate risk of fire, and that no part is exposed to excessive radiation. When there is no supply of steam, ventilating stoves or hot-water pipes must be used. As to the proper temperature, some difficulty arises owing to the fact that a certain temperature is regarded necessary for special processes. Thus, in certain kinds of cotton spinning, a temperature of 24° or 25° C. is regarded as necessary, although in others 18° to 20° appears sufficient. In workshops where prompt drying is required, this is attempted by raising the temperature, instead of by free ventilation.

Owing to the desire to economize fuel while maintaining a sufficient temperature, the air in workshops often becomes intolerably impure. Regulations as to ventilation therefore are indispensible.

When, however, one is required to determine the minimum space and hourly quantity of air which should be allowed for each worker, there are certain difficulties. The air in factories is not only vitiated by respiration and combustion, but also by exhalations from the materials used, by the dust and moisture of the floors, walls and roofs, by the odour of dirty clothing, etc. These conditions vary greatly in different industries ; it ought therefore to be the duty of Sanitary Authorities or their inspectors to regulate each case on

its own merits. It is, however, desirable to fix a minimum of 400 cubic feet of air for each person, which should be renewed at least four times an hour. When there is much dust or injurious vapours, the air should be renewed at least six times an hour.

In the industries in which manual labour is employed, vitiation of the air is much more frequent than when machinery is in use, as the latter takes up a large share of the available space.

To control the quality of the air respired, factory inspectors should frequently determine by simple and easily applied methods, the quantity of carbonic acid in it. Dr. Schuler, one of the most distinguished inspectors of Switzerland, remarks that these analyses frequently give results not in accord with the impression furnished by the sense of smell, and that one is most easily deceived when the temperature is high.

Schuler has found the following quantity of carbonic acid in 10,000 parts of air :—

In the rooms where one presses the stuffs . .	4·7– 6·3	mean	5·5
,, calico-printing rooms	4·0–12·6	,,	8·0
,, cotton-spinning rooms	5·4–14·8	,,	9·0
,, combing rooms	5·4–14·8	,,	9·5
,, weaving rooms	7·4–17·6	,,	15·0
,, cotton-bleaching rooms	12·6–22·0	,,	17·0
,, stocking factories	8·0–28·4	,,	17·5
,, knitted vest factories.	8·0–28·4	,,	17·6
,, tobacco works	30·0–44·0	,,	39·0

Ventilation by the windows being the simplest and most efficacious, especially in warm weather, all windows in a factory should be made to open. The upper panes should be made to open inwards, so that air may be admitted even in cold weather. As ventilation should be uninterrupted at all seasons, there should be special means for entry and outlet of air. In building a workshop it is desirable to have tubes in the walls. If necessary, mechanical means must also be employed to obtain the ventilation required. The regulation of the ventilation should not be left to the workmen themselves, for experience has shown, that owing to deep-rooted prejudices, they are the enemies of all ventilation. Being obliged by the smallness of their means to economize fuel in their own dwellings, they do not appreciate the necessity for pure air, and they have a morbid fear of chills.

In consequence of their debilitated and anæmic condition, they are very sensitive to changes of temperature. For this reason ventilation should be organized so as to avoid draughts; this can be managed by warming the air before it enters the rooms. This method is no more costly than heating the air already in the rooms.

The degree of humidity of the air is also important in relation to health. In houses, the relative humidity is usually 60 to 75 per cent. ; it may be less than this in cotton and other factories, where the material is very absorptive of moisture. Very hot air is usually extremely dry, and consequently disagreeable if not actually injurious. The better a place is ventilated, the nearer its humidity approaches that of the external air.

The maintenance of cleanliness in the work-rooms plays an important sanitary rôle. It is, however, often neglected. The ease with which this condition can be fulfilled depends much on materials of construction. Greasy matters and *débris* adhere to the floor or moisture percolates, and for this reason floors of asphalte or cement, which are impermeable are the best.

The walls should, preferably, be lime-washed or painted in oil. In the first case they should be white-washed at least once a year ; in the second case washing with soap and water suffices. An exception to this rule may be made in favour of certain industries.

The machinery should also be kept in good condition and free from oil and grease.

It is necessary also to see that the closets are kept in a sanitary condition. Earth closets should be employed where water-closets are not available. Sometimes a by-product of the manufacture may be employed for mixing with the excreta.

Hygienic Difficulties due to the Nature of the Work in Factories.—In addition to the drawbacks to work in factories already mentioned, in certain industries dangers arise from the unhealthy products of the work itself.

These products may be inoffensive in themselves, as dust and powders; or they may be infectious substances carried by dust; or poisonous chemical products.

It has been known for many years that inert powders may cause disease in a mediate manner; the mucous membrane, especially of the respiratory tract, being irritated and abraded, thus allowing the entry of pathogenic microbes into the body. Phthisis is common among the workmen in dusty factories; the harder and sharper the dust, the greater the danger.

Experience has shown that dust from organic matters is more injurious than that of inorganic substances. Organic powders are classed in the following order of nocuity: starch, sugar, wood, bone, horn.

The action of dust is increased by more rapid currents of air, which apparently indicates that the irritation and lesion of the mucous membrane are the chief cause of the injurious effects produced. It is also evident that the greater the amount of dust in the air, the more unhealthy it is.

There is now no doubt that smallpox and anthrax have both been propagated in manufactories, the first by rags used in making paper, the second by hides and by alpaca wool. It is therefore justifiable to suppose that other infectious diseases may be propagated in the same way.

In a large number of industries, noxious gases are evolved, but the amount of injury thus produced cannot be exactly gauged. Generally it is admitted that when the air is mixed with foreign gases which irritate the mucous membranes of the eye, nose, and respiratory tract; or when the air evolves a disagreeable smell, some injurious effect is produced. There are, however, deleterious gases which cause no irritation and have no smell, such as the carbonic oxide freely evolved in foundries.

The health of workers is exposed to even greater risks in factories where poisonous substances are employed or manufactured, and the most rigorous precautions are required to minimize this risk.

To protect workers against dust, a large number of respirators, masks, spectacles, etc., have been invented; but experience shows that the law is powerless to make the workmen wear them, because they cause some inconvenience and more or less impede work. Arrangements for the aspiration of air from each room are more practical, as they immediately draw off the dust which is formed. The use of wet processes instead of dry, has also in many industries done away with the objectionable dust.

In all these industries, it is important to allow an abundant cubic space for each workman, and to ventilate the room with great care. All crude materials open to suspicion should be disinfected, to prevent their directly spreading disease. For rags, wool, etc. the most efficacious method is the employment of super-heated steam.

Noxious gases should be either neutralized or expelled.

The factories in which poisons are employed should satisfy all hygienic requirements as to their construction, ventilation, and special precautionary measures, as well as be subject to a rigorous surveillance. It is important also that in such industries the day's work should be curtailed. If the employment of poisonous substances necessarily involves dangers, their use should, if practicable, be prohibited. Denmark and Finland, among other countries, have shown that this can be done by forbidding the use of yellow phosphorus for making matches; and in several countries the use of arsenic in industries is similarly forbidden.

In Switzerland the law on factories contains a very practical regulation, which ought to be adopted in all countries. This regulation requires that in all establishments in which the life and health of workpeople incur danger, the hours of labour shall be reduced sufficiently to enable the necessary precautionary measures to be taken. Excellent results have accrued from this regulation.

In the event of imminent danger, as from an explosion, all work ought to be able to be suspended until the danger has disappeared.

Accidents Caused by Work in Factories.—The accidents threatening factory workers are generally of less importance than the dangers to health and life arising from the nature of the work itself. The former, however, are sudden, unforeseen, and cause great alarm; while the latter act slowly and furtively, gradually destroying the vital powers, but escape attention.

The most serious accidents in factories are those caused by boiler explosions; and for this reason special enactments have been made on this subject. The most practical is to insist on the supervision of special engineers.

The most frequent accidents to workers are from machinery in motion. All parts of machines presenting danger should be protected. When difference of opinion arises on this point, the English law gives the manufacturers the right to submit the question at issue to the arbitration of three persons.

The placing of too many machines in a single room should also be forbidden; they ought not to be too near each other, and there should be sufficient space between them to allow the workers a convenient passage.

For this reason, when a new factory is about to be built, the plan should indicate the position of each machine in relation to others.

In some industries rules for the dress of workers are necessary, to prevent their being caught in machinery, or burnt, or impregnated with noxious matters, etc.

As workpeople often show repugnance to complying with regulations of this kind, their importance, and the dangers to which negligence exposes them, must be explained. It is desirable that the means adopted should be as far as practicable so organised that their use does not depend on the personal will of the workpeople.

It is important that any infraction of regulations should be punishable, and that active supervision should be exercised by overseers.

Food, Method of Life, and Dwellings of Workpeople.—Meals in the workshop should be forbidden. This would be a direct source of danger in certain industries, especially in whitelead and match manufactories. In other cases the air is more or less impure and loaded with foreign matters.

Where workpeople take their meals on the same premises as the factory, special dining-rooms should be provided. It is also desirable in the interests of health that provision should be made for heating the food, which can be done at a very small cost in factories where steam is employed.

The food of workpeople in factories is usually bad. This arises less from insufficiency of means than from scanty time for cooking and ignorance of methods of cooking. In several districts boarding-houses in common have been established, but the workpeople have not continued to use them, although the food there provided is better and more substantial than what they prepare themselves.

The provision of improved food and methods of cooking would benefit masters as well as workpeople, by the encouragement of robust health. To enable workpeople to obtain milk and cheese at cheap rates is to contribute materially to their health. Good water is essential. Spirits of all kinds or even beer, as well as smoking during the hours of work, should be prohibited.

Each factory should possess lavatories and a dressing-room in which clothing may be freed from dust and offensive emanations.

Workpeople should be strictly forbidden to pass the night in the factory or workshop.

When workpeople are lodged by the master, factory inspectors should exercise a strict supervision. Each workman should have a bed to himself with at least 400 cubic feet of space, of which 38 square feet is floor space. The ventilation should be such that the air is renewed at least three times an hour. (For further particulars as to workmen's dwellings see p. 166 *et seq.*)

The master should exercise some supervision over the morals of minors without parents who work under him. A register should be kept of these, noting their name and age, dwelling, and the names of the persons who have charge of them. This register should be checked each month, and shown to the factory inspector. Every change of address

should be at once noted. The masters should also encourage the formation of kindergartens and schools for young children, to diminish the strain of their care upon the parents.

The formation of sick-clubs should be obligatory. A doctor should be connected with each factory, whose duty it is to enter in a journal all cases of disease and detect any connection between the disease and the occupation of the patient. He should present an annual statistical report to the factory inspector.

Inspection of Factories.—Experience has shown that laws as to factories, however complete they may be, remain without effect unless their execution is supervised by an inspector. At first, before all the circumstances requiring consideration were taken count of, it was thought that the best inspectors would be those of the same trade, who would be able practically to suggest the best means against accidents. But when it was realized that accidents are very insignificant as compared with the dangers arising from chronic diseases due to the occupation, and that these could only be appreciated and combatted by a doctor, it became evident that such inspectors should possess medical knowledge.

The progress of sanitary science has produced a special class of medical hygienists, and these alone are competent to direct and supervise successfully the hygiene of factories. They have made hygiene a science, and shown the evil conditions which must be removed from factories, schools, etc., in order not to compromise the health of those engaged in them. It cannot therefore be denied that the functions of a factory inspector can only be properly discharged by a person having medical knowledge.

The carrying out of the measures suggested by the medical hygienist must be left to the manufacturer. The medical inspector's duty is confined to watching whether the measures adopted have the desired result.

In countries where there are factory inspectors each has his special district. Where, however, the inspection is completely decentralized, there is no uniformity in the measures required nor in the results obtained. It is necessary therefore that there should be a superior authority which would see that the action taken was uniform, and would collate the local reports, and report to the Government the results obtained. It would also submit to the inspectors important questions which they are required to study and settle. Valuable experience would thus be focussed, and made the best use of.

The centralization of factory inspection has already been organized in England and Austria, and here industrial hygiene has made immense progress. In Germany and Switzerland the question is left entirely in the hands of individual inspectors. The consequence in Germany is complaints and resistance on the part of manufacturers and no progress. In Switzerland the faults of this system are less felt, as each canton has its own special inspection, and the inspectors often meet ; and in addition they have, in one of the members of the federal government, a sort of chief to whom they can appeal.

It is not easy to state what ought to be the extent of an inspector's district. To clear up certain questions, the inspectors are obliged to make detailed studies occupying much time ; while, on the other hand, comparisons ought to be able to be made with a sufficient number of factories. The inspection of factories should not be confined to a control of the execution of legal requirements, but should also embrace a study of any possible ameliorations. The first of these duties might be fulfilled by a conscientious and capable man belonging to almost any class of society ; the second can only be carried out by competent medical hygienists.

There are many ways of arriving at the desired object. Each country would doubtless do best to take as a basis for its efforts the order of things already existing. New institutions require a certain length of time to be understood, and in the meantime the desired results cannot be obtained.

As the best laws are only of real utility if those they concern recognise their value, general hygiene and the hygiene of factories ought to form a subject of instruction in all industrial schools.

One might have considered under the head of industrial hygiene the protection of the

neighbouring population against any evil effect exercised by a given manufacture. Although this is not the place to consider this point, it is a very important one, and the governments of various countries have given it considerable attention. The general principle relating to such establishments is that they should be placed as far as possible from dwelling-houses fully exposed to the air, and that all precautions should be taken against the escape of noxious or offensive emanations.

Sanitary Provisions as to Industries.—The Factory and Workshop Act, 1878, and the amending Acts of 1878 and 1891, mentioned at pages 44–46, are applicable to London. The following additional details on industrial hygiene may be given.

The English law classifies industrial establishments as follows: textile factories, non-textile factories, workshops, workshops in which children and young women are not employed, and domestic workshops.

Factories are establishments in which steam-engines or other mechanical powers are employed. In addition certain workshops, even when no mechanical powers are employed, are considered as factories; *e.g.*, printing establishments, laundries, dye-houses, potteries, manufactories of matches, tobacco, book-binding, etc.

The regulations as to textile establishments are the most rigorous, because a large proportion of their workpeople are children and women.

The hygienic requirements for workshops are the same as for factories, but certain regulations in force for the latter are not obligatory for the former, unless made so by the Secretary of State.

The ventilation of factories, like that of hospitals, is remarkable for its simplicity, windows being the chief means used. Contrivances are in use for preventing cold currents of air. One of the simplest of these is *Hinckes Bird's ventilator*, consisting of a block of wood placed under the lower sash, thus admitting air between the two sashes. English windows do not ordinarily open like those on the continent inwards and outwards, but from the top and bottom. When the window is shut, the frames of the two sashes join exactly, while there is a space between them when the window is open.

As a means of exit for foul air the chimney is chiefly relied upon; but as the warm impure air escapes from this with difficulty near the floor-level, openings into the chimney near the ceiling have been arranged. To prevent the entry of smoke into the room, these are provided with movable flaps, shut by a descending current of air.

The chimney flue when thus employed for ventilation should not be much narrower than at the fireplace, otherwise the chimney would smoke.

Special shafts for foul air are also employed, and the ventilators of which mention has been made pages 99–105.

In accordance with the Factory Acts (pp. 44–66) no child under sixteen years should be employed in a factory without a medical certificate of good health. For this purpose the whole country is divided into districts, which are allocated to special *certifying surgeons*.

One of the doctors practising in a given district is generally charged with these duties by the chief inspector of factories.

Every person under eighteen years of age wishing to be employed in a factory should possess a certificate of age; he is examined by the factory surgeon, and if approved his name is inscribed in the *register of young persons*, to which the factory inspector has access at his visits.

The certificate of the surgeon is paid for by the manufacturer at a fixed rate.

As to the space reserved for each worker in an industrial establishment, there is no general rule in the English law. The inspectors regulate this according to the local conditions and the kind of industry. The inspectors' instructions sometimes contain a clause that the minimum space for each day-worker should be 250 cubic feet, for each night-worker 400 cubic feet. Three gas-burners should be considered as equivalent to one person.

Measures against Accidents.—According to the degree of danger presented by machines, the English have practically classified them as *mill-gearing* and *machinery*. Mill-gearing includes every vertical, inclined, or horizontal axis, every wheel, or pulley arrangement to which the force of the machine is transmitted to put in movement another machine of the factory. All these parts should be protected during work, as should also every leather strap situated where persons have to pass, every beam in direct connection with the mechanical power, every part of the steam-engine or water-wheel, etc.

Machinery is supposed to include every machine or part of a machine not included in the name of mill-gearing. Machinery needs to be protected only when the factory inspector requires it, and if any difference of opinion arises an arbitrator may be appointed to decide. The same applies to coppers full of boiling water or molten metal, placed where children may come near them.

There are also regulations for protecting against whetstones put in motion by mechanical power. Children are forbidden to cleanse *machinery* in motion, while women and young persons are forbidden to cleanse *mill-gearing*. It is forbidden equally to children, women, and young persons to work between the fixed and traversing part of any self-acting machine while the machine is in motion by the action of mechanical power.

When a worker in a factory or workshop has been injured by a machine put in motion by mechanical power, or has been scalded by a copper containing boiling fluid, to an extent which prevents his working for forty-eight hours, the master is bound to give written information of the fact to the factory inspector. He should also report without delay to the factory surgeon, whose duty it is to report within twenty-four hours as to the circumstances connected with the accident. The surgeon's fee for this report is paid by the State. This system has been found to work well in practice, as it brings to the knowledge of the administration a large number of facts as to the most frequent accidents and their causes.

The measures taken under this head have during the four years 1883–87

reduced the number of accidents in English factories from 10,000 to 6,000 (Whymper). The same system serves as a check to ensure the activity of the district inspectors.

School Instruction of Children Employed in Factories.—The following regulations are in force as to the instruction of children employed in factories :—

Children are not allowed to go to work until they have passed certain elementary standards of examination.

Children working during half of each day (p. 44) should in the other half day attend school, with the exception of Saturday, which is free. The hours of school and of work should alternate weekly.

Children working in the factory the whole day every other day should attend the school on alternate days, but not on Saturdays. The days of school and of work should be changed each week.

The instruction of children is chiefly under the control of School Boards, who are under the general direction of the Government Education Department. The latter prescribes the course of instruction for the children. The system of half-day schooling has been found to answer better than that of alternate days schooling, unless in exceptional cases, when the distance from school is great.

Inspection of Factories.—When the inspection of factories in England was started in 1833, four chief inspectors and eight assistant inspectors were employed. As the result of years' experience, the number of the first has been reduced, while the number and the grades of the latter have been increased.

The inspection of factories in England is now administered by a chief inspector, 5 superintending inspectors, 50 inspectors, and 10 junior inspectors.

The chief inspector is responsible for all inspections made and the carrying out of the Factory Acts throughout England. He resides in London, and is under the Secretary of State, to whom he should report on the details of his department. His offices are at the Home Office in Whitehall, where he has a large staff of clerks.

The superintending inspectors are under the chief inspector, and control the inspectors. They each reside in their own district, and receive weekly reports from the inspectors, forwarding them with their own special report to the chief inspector. The superintending inspectors visit the factories and factory schools in their district, either alone or accompanied by the local inspectors. In all grave matters they must act under the instruction of the chief inspector.

The inspectors are under the immediate control of the superintending inspectors. They should employ five days weekly in the inspection of factories and the sixth in correspondence. Each week they forward a detailed report of their work to the superintending inspector. Under the order of the latter, it is their duty also to take proceedings for breach of the Factory Acts. If the inspector has under him an assistant-inspector,

he arranges his work, receiving and forwarding his reports to the superintendent.

Résumé of School Hygiene.—The hygiene of schools is both public and private. Public hygiene comprises:—

1. The locality, construction, ventilation, heating, lighting, cleansing, water-closet arrangements, furniture and teaching materials of the school.
2. The hours for class-work, for rest, for food, and for exercise.
3. Measures for preventing the development of infectious diseases and other disorders of health.

Private hygiene comprises the supervision of the state of health of each pupil and the amount of work that he can bear.

There are few countries in which the hygiene of schools is regulated throughout by the law, much being still required in this respect.

The Site and Construction of the School.—The site should be open, dry, and somewhat elevated; it should not be near stagnant water, hospitals, cemeteries, factories, or too frequented streets; it should have an open playground for play, etc.

The class-rooms should form a rectangle with a minimum floor space of 12 square feet per pupil. The height should not be less than 12 feet. The most convenient shape of room is with the width and length in the proportion of 3 to 5. Each pupil should have 170 to 200 cubic feet of space with continuous ventilation.

The windows should be so arranged that each part receives abundant day-light. The interval between windows should be as small as possible. The total superficies of the windows should be at least $\frac{1}{7}$ to $\frac{1}{6}$ of that of the floor. They should be rectangular or slightly curved; the bottom should be 4 feet above the floor, and reach to 6 inches from the ceiling; they should as a rule only be placed on one of the long sides of the room. The upper squares should open inwards.

Each room should have if possible a separate entrance. The ceiling should be even and white. Cornices are objectionable, as they allow the collection of dust.

The walls should be wainscoted to a height of 4 feet, and painted of a bright colour. The floor should be of hard and waxed parquet, or of close-knit boards stained and varnished. The doors should preferably be single, 3 feet wide.

If there are several storeys, the stairs should be straight. After each stage of 13 to 16 steps, there should be a landing. The staircase should be from 5 to $6\frac{1}{2}$ feet wide; the height of the steps should not exceed 6 inches and their width 12 to 16 inches.

It is necessary to be able to heat and ventilate each room separately; separate is therefore better than central heating. The simpler the arrangements, the better.

To prevent the introduction of infectious disease, no room in a building used as a school should be inhabited.

Water-closets or earth-closets are the best arrangements for excreta. The pail system may be employed with strict supervision. In boys' schools one closet is required for each class; in girls' schools, two. Boys' schools should also be provided with urinals. The closet seats should be 12 to 16 inches high, the openings oblong, measuring 8 by 6 inches and 4 inches from the front edge of the seat. The closets are separated by partitions reaching from floor to ceiling. The doors should open outwards.

The ground should be impermeable, and all wood-work painted or varnished. The closets should be so placed and ventilated that no smell is perceived in the playground.

School Furniture.—Since school hygiene has been studied, a large amount of school furniture has been manufactured; steady improvements have been made, the object being to prevent bodily deformities, and to arrest the progress of myopia, the results of fatiguing work. The principal points about the construction of this furniture are as follows. They should be made in at least three different sizes; the pupils being placed not in accordance with their knowledge, but their size. The seats should be so placed that the pupil can write with comfort. They should be from 9 to 11 feet wide; the height from the floor being about $\frac{2}{7}$ of the length of the body, *i.e.* from 12 to 18 inches, and such that

the thighs and legs form almost a right angle when the feet rest on the ground. They should also be provided with a back-rest.

The desk should have a width of 15 to 18 inches, and an inclination of 1½ to 2 inches. The space on the seat for each pupil should be from 20 to 24 inches.

The height of the pupil above the seat is generally $\frac{1}{6}$ of the length of the body, or more exactly $\frac{1}{7}$ of the length plus 2·4 inches.

The seat and desk should be fixed to each other. The distance between the front of the seat and the edge of the desk is ordinarily *nil*. Some think it advantageous that the distance should be a negative quantity, *i.e.*, that the edge of the desk should overlap the seat to the extent of 1·2 to 2·4 inches; in the last case the seat or the top of the desk should be movable to permit the pupil to remain upright. This method has not been found to work very well.

Even when the distance is 0 there is slight inconvenience; the majority prefer a positive distance, which should however be as small as possible, as otherwise the position of the body is too much inclined forwards.

Desks with seats for only two scholars are considered the best. In placing seats and desks, a space of 10 inches between the rows and a distance of at least 24 inches from the wall should be left.

The Lighting of Schools.—An important part of school hygiene consists in the prevention of myopia. This is particularly prejudicial to the poor, who have difficulty in procuring suitable glasses, and who are cut off from certain kinds of work by the use of glasses. Since instruction has become obligatory, this aspect of school hygiene has demanded increased attention.

Advanced myopia may produce, in later years, serious troubles, such as disorder of the lens, inflammation of the retina, etc., indicating the necessity for the prevention of myopia during school life.

Myopia may be hereditary, *i.e.* the offspring of myopic parents are more likely to contract it than others. But experience has shown that in a great number of cases, children of normal vision, born of parents who also had normal vision, become myopic during school life. There is now no reasonable ground for doubting that fatigue of the eyes, the result of bad lighting and protracted attention to near objects is one of the chief causes of this disorder of vision.

The lighting of the school plays an important rôle. In speaking of the school site, we have shown how the best results can be obtained.

The seats should be so placed that the light falls from the left side; and from each seat one ought to be able to see the sky.

The commission of school hygiene for Paris has made the following rule: if the eye is placed at the same height as the table, the sky should be visible from the upper end of the window towards the bottom to an extent of at least one foot.

The researches of Professor Cohn of Breslau have shown that to avoid fatigue of the eyes, the minimum intensity of light for lighting each room should be equal to 10 metres of light (a metre of light is the intensity of a normal light at the distance of a metre). In daylight, 10 metres of light correspond to an angle (Raumwinkel) of 50° square. (The angle spoken of is the angle which the rays of light coming from the sky through the window form with the working table. A degree square is a square the sides of which are equal to a degree.)

Teaching should be done preferably during the day. If artificial lighting is necessary, it should have an intensity of at least 10 metres of light for each pupil. The flame should be surrounded by glass, and have a shade. It should be noted in connection with the establishment of lighting, that the light may be obstructed by the heads of the pupils; also that even the best lamps, with shades 9 inches above the pupils' heads, do not furnish the necessary 10 metres of light at a distance exceeding 20 inches on all sides.

All lamps should be so placed that the heat and products of combustion from them are removed and ventilation thus helped (see p. 159). Direct sunlight should not fall directly at any spot, blinds being provided to avoid this. M. Cohn proposes ground glass as a good protection against direct sunlight.

Appliances for Teaching.—Books should be printed in clear and good-sized type. The height of the *n* should not be less than 1·5 millimetres, and the thickness of the strokes 25 millimetres. The distance between words should be at least 2·5 mm. and between the letters 0·75 mm. The lines should not be more than 10 centimetres long.

The French commission on schools has adopted the following proposition of Dr. Gariel: the lines of school books should not exceed 8 centimetres in length, there should not be more than 7 letters on each centimetre, and the letters should be sufficiently large to be able to be read by a person of normal vision at $2\frac{1}{2}$ feet distant with a light placed $3\frac{1}{3}$ feet from the book. In general, the thicker the characters of the letters in school books, the better. The type should be clear and thick-faced, each stroke of the letter and the space between two strokes being visible at a distance of $3\frac{1}{3}$ feet under an angle of one minute.

Annotations in small type should not be allowed. The lettering on maps and blackboards should be large and clear, so that it can be read from the other side of the room under an angle of a minute. The surface should not be polished.

The paper of books should be white or tinted yellow, of an even thickness, soft and not transparent, not rough or sticky. The ink should be black. The pupil should not in writing hold his copybook on his right side, but just in front of the middle of his body, as this is the only position necessitating sitting upright. If the book is held to the right, the writing should be round-handed and not sloped.

No work should be allowed in school necessitating holding the book at a less distance than 12 inches.

Hours for Class Work, Rest, Meals, and Exercise.—Children have an imperative need for bodily movement; to sit uninterruptedly for a long time fatigues both body and mind and may even cause serious disorders. Too little exercise during the years of school life produces a general disorder of nutrition and development. The consequences are a fatigued and relaxed appearance, a pale skin, badly developed muscles, a feeble gait and walk; in a word, what is characterized by the expression *jeunes vieillards*.

Recent legislation as to schools, in all countries, has made efforts to prevent these results of unbalanced intellectual work, but there is as yet no complete agreement as to these regulations.

The American proposal known as *the three eights* most nearly approaches this object, *i.e.* for each pupil 8 hours' sleep, 8 hours' work, and 8 hours' recreation.

In Germany the propositions of the *Strasburg Commission* (Aertzliches Gutachtes über das höhere Schulwesen Elsass-Lothringens, Strassburg, 1882) may be regarded as the best. According to these, the home-work for superior schools should be reduced:

For the ninth to the seventh (inclusive), to six hours weekly;

For the sixth to the fifth, to eight hours;

For the fourth to the third, to twelve hours;

For the second to the first, twelve to eighteen hours.

It is evident that with so little home-work, better teachers would be required. For this reason in Germany only teachers are accepted who have received special training for the work. The hygiene as to teaching should be in conformity with the remaining parts of school hygiene.

Instruction should not be carried on during several successive hours; each hour's work should be followed by a short interval for recreation.

According to the experience of Finland, concentration of the hours of class-work into the first half of the day has been found less fatiguing to the general health of the pupils, as well as to the eyes, as the work is done by daylight.

Four meals a day are required by children; breakfast before going to school, a mid-day meal, a third after the afternoon's school, and an evening meal an hour before bedtime.

Gymnastics and regular bodily exercises should occupy a much greater space in school life than at present. The exercises carried out in French and Swedish schools,

form, with gymnastics, a very efficient means of developing and perfecting the physical powers. The exercises should always be carried on in the open air, not exposed to dust, and should be done in small groups, so that each may have a sufficient supply of fresh air.

Preventive Measures against Illness.—Infectious diseases are spread with great ease by schools, and legislative measures against this are absolutely necessary.

The diseases against which such measures are required are :

1. Smallpox, typhus and remittent fevers, measles, scarlet fever, diphtheria and cholera ;

2. Typhoid fever, contagious inflammation of the eyes, whooping cough, scabies and ringworm. Any of these affections should preclude a child from attendance at school, and the same applies in most cases to healthy children coming from an infected household. The children should not be allowed to resume school attendance until the period of infection has passed. This should be at least six weeks for smallpox and scarlet fever, and a month for measles. The children should have been bathed and their house and clothing disinfected before they return to school. Infected children must not be conveyed from one place to another. The same rules should also apply to institutions. If a boarder falls ill at a school, the doctor will decide whether it is necessary to shut the school or (more generally) only to remove the patient and disinfect the premises.

In times of epidemics, the school premises should be kept scrupulously clean, each room well ventilated, and water-closets daily cleaned and disinfected.

The school should be closed if infectious disease has arisen in consequence of the insanitary condition of the school premises, in order to enable the necessary work to be done without danger to scholars.

The Supervision of School Hygiene.—The present position of school hygiene in civilized countries has not been secured without struggles between teachers and school managers on the one hand and doctors on the other. School managers have not wished for the intrusion of an outside authority into their territory, and have often misinterpreted just requirements. Hygienists have made a mistake in drawing a sharp line between the public and private hygiene of schools.

In examining the public hygiene of schools, every one will admit that special doctors are not absolutely necessary, for when the necessary principles are laid down and the initiation has been taken, the school teachers may supervise its application, subject to control on the part of medical officers for the prevention of the spread of infectious diseases and the removal of any insanitary condition of the school premises.

The condition of health of the individual pupils belongs to *private hygiene*, and should not be included as a rule in the scope of visits of medical officers of health or sanitary inspectors. In most countries this is left to the responsibility of the parents of pupils.

It would appear that if all measures relating to the public hygiene of schools are taken, the state and the school authorities have done all that can be required from them to preserve children from injurious influences in their school life. The personal hygiene of scholars, each having a different constitution, hereditary tendencies to certain diseases, etc., should be controlled by the parents or guardians, except at boarding schools.

The beneficent measures taken by the state and communities for the rescue of pauper and invalid children, for holiday colonies, etc., are matters belonging rather to the question of sick relief than to school hygiene.

Sanitary Regulations as to Schools.—In London and in England generally medical officers of health and inspectors of nuisances supervise the public hygiene of schools. The former exercises a supervision for the prevention of the spread of infectious diseases and the general sanitary conditions of the school ; while the latter reports as to ventilation, cleansing, drainage, etc. Defects are reported to the sanitary authorities, and the necessary notices served on the school managers.

By the Code of Regulations of the Education Department, the school managers are required to comply with any notice of the Sanitary Authority requiring them for a specified time, with a view to preventing the spread of disease, either to close the school or to

exclude any scholars from attendance, subject to an appeal to the Department after complying with the notice.

The systems of heating and ventilation used in schools are generally similar to those in use in hospitals and other large buildings.

In schools it is particularly important that the floors should be of a material not causing much noise. The best floor for this purpose used in London, both in schools and hospitals and other buildings, consists of blocks of wood, with asphalted joints, placed on a bed of cement (Fig. 60).

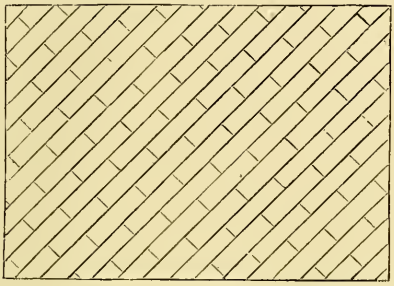


FIG. 60.—FLOOR WITH ASPHALTED JOINTS.

SCOTLAND.

CHAPTER I.

SANITARY LEGISLATION.

General Review.—Sanitary Legislation.—Board of Supervision and Local Boards.—Removal of Nuisances.—Prevention of Diseases under order in Council.—General Prevention of Disease.—Common Lodging-Houses.—Sewers, Drains, and Water Supply.—Vaccination Act.—Hygienic Regulations as to Schools.—General Police Act for Scotland.—Poor-law Regulations in Districts: *not subsidized by the State: subsidised by the State.—Specimen of Sick Register for Paupers.*—Regulation of Dairies, Cowsheds, and Milkshops.—Other Sanitary Laws.—Results produced by the Sanitary Laws.

General Review.—Scotland has been included in Great Britain from the time of James I., the son of Mary Stuart. Since the reign of Queen Anne, Scotland has had no separate parliament, but has representatives in the House of Commons, sitting in London. England and Scotland are, however, not yet completely united. There is in the latter great local patriotism, difficult to explain to strangers, but which is based on the most honourable foundation, and produces an honourable struggle for the general advancement of the nation.

The enterprise of the Scotch is such that there is an English proverb which says: "If an Englishman succeeded in reaching the Arctic Pole, he would probably find a Scotchman on the top."

The Scotch profess the Protestant religion. The severity of their religion and the serious character of the nation give a religious aspect to the whole country. This strict observance of religion in the daily life has doubtless great influence for good on the morals of the Scotch.

As the manner of life and the morals of a people have great importance from a hygienic standpoint, it might be expected that the death-rate in Scotland would not be high. It only averaged 18·8 per 1,000 for the five years 1886–90, although the population is in many parts dense, and there are many manufactures.

The Scotch administration has remained to the present time almost independent. It has a special administration and Public Health Act. Nevertheless it cannot be said that its sanitary organization differs much from that of England. As one Parliament passes these Acts of Parliament, it goes without saying that they only differ in minor details.

The sanitary organization of Scotland is most nearly analogous to that of London. It was the intention to apply to the whole of Great Britain the English sanitary code of 1866, which was in force in London until recently; but as certain parts of it were not applicable to Scotland, the

Board of Supervision obtained in 1867, through the Scotch Lord Advocate, the acceptance by Parliament of the sanitary code now in force (Public Health (Scotland) Act, 1867; Amendments, 1871–82).

Sanitary Legislation.—**Board of Supervision and Local Boards.**—The *Board of Supervision* is the chief Sanitary Authority in Scotland. It is subordinate, like the late Metropolitan Board of Works of London, in certain respects to the Privy Council, which in the event of serious epidemics publishes regulations for their control in Scotland.

In addition to the supervision of sanitary administration, the administration of poor-relief is under the Board of Supervision. The Board consists of a Secretary with a fixed salary, the Lord Provosts of Edinburgh, Glasgow, Aberdeen, and Dundee, the Sheriffs of Perth, Renfrew, Ross, and Cromarty, and the Law Officer of the Crown. In the event of grave epidemics and of special regulations by the Privy Council, a sheriff of another county may join the Board of Supervision.

The Board has five inspectors, who inspect the carrying out of vaccination and poor-relief. These inspectors, who are all hygienists, report to the Board of Supervision, and these reports are published.

The municipal councils of towns and of rural districts discharge the functions of local Sanitary Authorities. The Board of Supervision decides what shall be the boundaries of these authorities, and whether they shall form rural or urban sanitary districts; and may, when necessary, modify these boundaries.

Each district *may*, and if the population is over 2,000, *shall* have one or more sanitary inspectors. They receive instructions which must be approved by the Board of Supervision, which keeps a record of the appointment of all inspectors. Inspectors cannot be dismissed without the sanction of the Board of Supervision except in towns with over 10,000 inhabitants.

If two or more persons complain of any serious nuisance in a rural district, the Board of Supervision may send an inspector to hold a local inquiry and hear evidence. It possesses the same power for urban districts with less than 10,000 inhabitants; for great towns it is necessary to receive the authority of Her Majesty's Secretary of State, or the Lord Advocate of Scotland, who can then authorize a local inquiry.

The Board of Supervision appoints its own staff for supervising the public health, but the nominations must be submitted to the judgment of the Secretary of State. The salary of these officers must be authorised by the Commissioner of Her Majesty's Treasury.

Removal of Nuisances.—The word "Nuisances" includes under this Act:—

(*a*) Any insufficiency of size, defect of structure, defect of ventilation, want of repair or proper drainage, or suitable water-closet, or privy accommodation or cesspool, and any other matter or circumstance rendering any inhabited house, building, premises, or part thereof, injurious to the health of the inmates or unfit for human habitation or use.

(*b*) Any pool, watercourse, ditch, gutter, drain, sewer, privy, urinal, cesspool, or ashpit so foul as to be injurious to health, or any well or other water supply used as a beverage or in the preparation of human food, the water of which is so tainted with impurities or otherwise unwholesome as to be injurious to the health of persons using it, or calculated to promote or aggravate epidemic disease.

(*c*) Any stable, byre, pigsty, or other building in which any animal or animals are kept in such a manner as to be injurious to health.

(*d*) Any accumulation or deposit of manure or other offensive matter within fifty yards of any dwelling-house, within the limits of any burgh, or wherever situated, if injurious to health, or any accumulation of police manure within a quarter of a mile of the municipal boundaries of any burgh (excepting the city of Glasgow), or any accumulation of deposits from ashpits or manure from town or village laid nearer than fifty yards to a public or parish road or dwelling-house.

(*e*) Any work, manufactory, trade, or business injurious to the health of the neighbourhood, or so conducted as to be offensive or injurious to health, or any collection or bones or rags injurious to health.

(*f*) Any house or part of a house so overcrowded as to be dangerous or injurious to the health of the inmates.

(*g*) Any factory, workshop, or workplace, not under the operation of any general Act for the regulation of factories or bakehouses, and not kept in a cleanly state, or not ventilated in such a manner as to render harmless, as far as practicable, any gases, vapours, dust, or other impurities generated in the course of the work carried on therein, and injurious or dangerous to the health of the persons employed therein, or any such factory, workshop, or workplace, as is so overcrowded, while work is carried on therein, as to be dangerous or injurious to the health of those employed therein.

(*h*) Any fireplace or furnace which does not as far as practicable consume the smoke arising from the combustible matter used in such fireplace or furnace, and is used within any burgh, for working engines by steam, or in any mill, factory, dyehouse, brewery, bakehouse, or gaswork, or in any manufactory or trade process whatsoever.

(*i*) Any chimney (not being the chimney of a private dwelling-house) sending forth smoke so as to be injurious to health. Provided that in places where at the time of the passing of this Act no enactment is in force compelling fireplaces or furnaces to consume their own smoke, the foregoing enactment as to fireplaces and furnaces consuming their own smoke shall not come into operation until the expiration of one year from the date of the passing of this Act.

(*j*) Any churchyard, cemetery, or place of sepulture so situated or so crowded with bodies or otherwise so conducted as to be offensive or injurious to health.

If the Local Authority or sanitary inspector have reasonable grounds for believing that nuisance exists in any premises, they may demand admission

for the purpose of inspecting the premises; and in the event of refusal to admit, compulsory power may be obtained from a magistrate. Any person refusing to obey the order for admission from a magistrate is liable to a penalty not exceeding £5.

Under (*e*) and (*g*) the necessary steps for abating the nuisance can only be taken on the certificate of the medical officer or on a requisition in writing from ten inhabitants of the district.

If the offending person does not carry out the necessary work for abating a nuisance he is liable to a penalty of 10*s.* to 20*s.* for each day during which he makes default; except under clauses (*e*), (*g*), and (*h*), in which penalties up to £100 may be inflicted; unless it be shown under (*h*) that the best available means for mitigating the nuisance have been taken. In the event of non-compliance with orders made, the justice may warrant any person to enter the premises and do the required work, and the cost may be subsequently recovered from the author of the nuisance or the owner of the premises.

Any water-course, ditch, or drain alongside any street or lane used for the conveyance of water or sewage, shall, if required by the Local Authority, be carried away by means of a sewer, to be constructed by the Local Authority, the owners of the abutting premises having to pay the cost of this sewer.

The sanitary inspector may at all reasonable times enter any premises to inspect and examine any carcass, meat, poultry, game, flesh, fish, fruit, or vegetables exposed for sale, or which there is probable cause for believing to be intended for human food; he may seize such carcass, etc., and if it appears to be unfit for food, bring it before the sheriff or any two justices, who will, if they agree with the inspector, order the same to be destroyed. The person to whom the carcass, etc., belonged shall be liable to a penalty not exceeding £10.

It is forbidden to allow to flow into any stream, well, or reservoir used for the supply of water for domestic purposes, any deleterious substances from the manufacture of gas, naphtha, vitriol, paraffin, dye stuffs, etc., the penalty inflicted for wilfully offending against this regulation being a maximum of £50.

The business of a blood boiler, bone boiler, tanner, slaughterer of cattle, horses, or other animals, soap boiler, skinner, tallow melter, tripe boiler, or other trade or manufacture injurious to health, shall not be established after the passing of this Act in any place in a town or village, or within 500 yards therefrom, without the written consent of the Local Authority. The Local Authority may make any bye-laws for regulating such offensive trades.

Prevention of Diseases under Order in Council.—Whenever any part of the United Kingdom appears to be threatened with, or affected by any formidable epidemic, endemic, or contagious disease, the Privy Council may order the necessary special preventive measures to be taken. The regulations thus given are in force for six months or any shorter specified period, after publication in the *Edinburgh Gazette*.

The Board of Supervision is required to carry out these regulations and to employ the necessary staff for this purpose.

The regulations provide—

For the speedy interment of the dead;

For house to house visitation;

For the dispensing of medicines, and for affording such medical aid and accommodation as may be required.

For any such matters or things as may appear to them advisable for preventing or mitigating the diseases.

Parliament must be made cognisant with any regulations that are published, and with the measures taken by the Board of Supervision. Local Authorities are obliged to carry out the orders of the Board of Supervision. When any such order in Council is in force in any place, if the sanitary inspector, medical officer, or any two medical practitioners certify that a house is so overcrowded as to be dangerous to health, the Local Authority has power to apply to it the regulations in force for common lodging-houses.

The preceding regulations apply to ships and vessels in ports and arms of the seas, as well as on inland waters.

General Prevention of Disease.—Local Authorities may provide hospitals for the reception of the sick. The plan and position of such hospitals must be approved by the Board of Supervision. They may also authorise the joint use of a single hospital by neighbouring districts.

Each Local Authority may provide a proper place and apparatus for disinfection of clothing, bedding, etc., which have become infected, and may cause any articles to be disinfected free of charge. They may also provide proper carriages for conveying patients suffering from infectious disease.

If the Local Authority is of opinion, upon the certificate of any qualified medical practitioner, that the cleansing and disinfection of any house and articles therein would tend to check infectious disease, it is their duty to give written notice requiring this to be done by the owner or occupier of the house; and he is liable to a penalty for default. If the occupier or owner is unable through poverty effectually to carry out the cleansing and disinfection, the Local Authority may do the work at their own expense.

Any person suffering from any dangerous infectious disorder and without proper lodging or accommodation, or lodged in a room occupied by others besides these in attendance upon him, or being on board any ship or vessel may on order of a sheriff or justice be removed on the certificate of a medical practitioner to the hospital of the Local Authority where this is provided; or accommodation may be provided elsewhere for those not in attendance on the sick person.

Any Local Authority may provide mortuaries, and where these are provided the body of any person having died of any infectious disease which is retained in a room in which persons live or sleep, or any dead body which is in such a state as to endanger the health of the occupants of the same house, may, on the certificate of a medical practitioner and order of

a justice, be removed to the mortuary. Any unclaimed bodies found within the district of a local authority must be buried by them.

Local Authorities may make regulations for places with more than 1,000 inhabitants

(1) For fixing the number of persons who may occupy a house, or part of a house, which is let in lodgings or occupied by members of more than one family :

(2) for the registration of houses thus occupied :

(3) for their inspection, and maintenance in a cleanly and wholesome state :

(4) for enforcing in them the provision of privy or water-closet accommodation and other appliances and means of cleanliness in proportion to the number of lodgers and occupiers, and the cleansing and ventilation of common passages and staircases :

(5) for their cleansing and lime-whiting at stated times : and (6) for the enforcement of the preceding regulations by penalties not exceeding 40*s.* for each offence, with an additional penalty of not more than 20*s.* for every day of default.

No cellar or underground room can be used as a dwelling-place, (*a*) whose height is not 7 feet if the house was built prior to the passing of this Act, or 8 feet if built subsequently, (*b*) or having less than one-third of its height above the level of the street or ground adjoining, (*c*) unless it has an open area 2 ft. 6 in. wide from the floor of the cellar to the street ; (*d*) unless it has appurtenant to it the use of a water closet, or privy, and ashpit ; (*e*) unless it has a glazed window made to open to the full extent of half of it, and with an area of 9 square feet clear of the frame, (*f*) and a fireplace with a flue, and (*g*) a drain, the highest point of which is at least 1 foot below the level of the floor of the cellar. Any person allowing a cellar to be occupied after receiving a notice, contrary to the preceding section, is liable to a penalty of 20*s.* for every day after the first conviction for this offence during which the cellar continues to be used as a dwelling-house ; and after two convictions under these provisions, an order may be made to close the premises permanently or for a specified time.

Any person suffering from an infectious disorder entering, or any person in charge of such infectious person placing him in any public conveyance without previously notifying to the owner of it or person in charge that the person is so suffering, is liable on conviction to a penalty not exceeding £5.

Any person suffering from an infectious disorder who wilfully exposes himself without proper precautions in any public place, and any person in charge of such sufferer, and any owner or person in charge of a public conveyance who does not immediately provide for its disinfection after having to his knowledge conveyed such sufferer, and any person who without previous disinfection knowingly gives, sells, transmits, or exposes any bedding, clothing, or other things which have been exposed to infection, is liable on conviction to a penalty not exceeding £5.

Any person knowingly letting a house or part thereof in which has been any person suffering from any infectious disorder, without having it disinfected to the satisfaction of a medical practitioner, is liable to a penalty not exceeding £20.

Every person not periodically providing for the removal of manure from stables, etc., after notice to this effect has been given by the Local Authority, is liable to a penalty not exceeding 20*s.* for every day during which the manure is permitted to accumulate.

Any ship lying in any river or harbour is subject to the nearest Local Authority, as if such ship were a house. Any ship within three miles of the coast and not within the district of a Local Authority, shall be deemed to be within the district of the nearest Local Authority, or of such Local Authority as is appointed by the Board of Supervision.

Every ship having on board any person suffering from a dangerous or infectious disorder is subject to the laws relating to quarantine (pp. 35–36).

Local Authorities are empowered to provide and maintain grounds for public recreation.

Common Lodging-Houses.—It is the duty of each Local Authority to keep a register of the names and residences of the keepers of all common lodging-houses within its district, their situation, the number of lodgers authorized to be kept therein and in each room.

The Local Authority may refuse to register as the keeper of a common lodging-house any person not producing satisfactory certificates of character; they may also vary the sum payable *per* night, but so as not to exceed 6*d.* per night.

It is not lawful to keep any such house until it has been inspected and approved and registered for this purpose.

The Local Authority may make regulations in detail for—

(*a*) The well-ordering of common lodging-houses.
(*b*) The separation of the sexes therein.
(*c*) Fixing the number of lodgers for each room.
(*d*) Promoting their cleanliness and ventilation.
(*e*) Their inspection.

Infringement of any of these regulations involves on conviction a penalty not exceeding £5, and 40*s.* for each day of continuance of the offence after written notice.

These regulations must be approved by the Board of Supervision, and a copy of them must be hung up in each room in which lodgers are received.

Where in the opinion of the Local Authority a common lodging-house is without a proper water supply, and can be supplied with it at a reasonable cost, the owner may be required to obtain such supply.

It is the duty of the keeper, if required by the Local Authority, to report every person who resorted to the common lodging-house during the preceding day or night; and also in every case to give immediate information as to any person ill of any infectious disorder.

Any officer of the Local Authority must have free access to a common lodging-house at all times.

The keeper is required to thoroughly cleanse all rooms, passages, stairs, floors, windows, doors, walls, ceilings, privies, ashpits, cesspools, and drains belonging to the common lodging-house as often as required by any regulations of the Local Authority, and to limewash the walls and ceilings in the first week of the months of April and October in each year, and at such other special times as the Local Authority may prescribe.

When the keeper of a common lodging-house is convicted three times of an offence under this Act, he may be prevented from keeping a common lodging-house for five years.

Sewers, Drains, and Water Supply.—All sewers within a district, and not being private property, are vested in the Local Authority. The Local Authority has power to construct any sewers necessary for keeping their district properly cleansed and drained. They may also alter or close up any sewers, provided that if any person is thereby deprived of its lawful use, the Local Authority shall provide another for his use.

The sewers must be so constructed and kept as not to be a nuisance, and for this purpose the Local Authority may construct such works as are necessary.

The Local Authority may for the purpose of utilising sewage arrange with any person for its supply or for distribution over land, for a period not exceeding five years, or with the consent of the Board of Supervision for a period up to 25 years.

Any owner or occupier of premises within the district of a Local Authority is entitled to cause his drains to discharge into the sewers of the Local Authority, after giving twenty days' notice, and complying with the regulations as to the mode of carrying this out.

No building can be erected over any sewer without the consent of the Local Authority, and no vault or cellar so made as to interfere with any sewer.

Proper traps and means of ventilation so as to prevent deleterious exhalation shall be provided for all sewers and drains.

The proprietors of distilleries, manufactories, and other works are bound where possible to construct reservoirs for receiving and depositing the refuse of such works, so far as it is offensive or injurious to the health of those living in the vicinity, or to use the best means for rendering it innocuous before discharging it into any stream, ditch or sewer.

If a dwelling-house, manufactory, or other work is without a drain, or without a sufficient drain, the Local Authority may require the owner to construct one emptying into a sewer, if the sewer is not more than 100 feet distant from the site of the premises, or otherwise emptying into a covered cesspool. If the person on whom the notice is served fails to comply with it, the Local Authority may do the work required and recover the expenses from the owner.

Two or more Local Authorities may combine for the execution of works of sewerage.

Towns having a population of more than 10,000 persons may contract with any water company to provide a supply of water for the sanitary and other public purposes of this Act.

In respect to towns and districts with a smaller population—

(1) The local authority may provide for a supply of water for domestic purposes, and for this purpose may execute any necessary works for digging wells, maintaining waterworks, etc.

(2) If any house within the district is without a proper water supply, the Local Authority shall compel the owner to obtain one.

(3) The Local Authority may supply any surplus water for public baths and washhouses, or for trading and manufacturing purposes on specified terms.

(4) They may continue the use of all existing public cisterns, pumps, wells, etc, for the gratuitous supply of water to the inhabitants.

Vaccination Act, 1863.—Vaccination has been obligatory in Scotland since 1863, in virtue of the above Act of Parliament. Infants must be vaccinated before reaching the age of six months. Each district must appoint a public vaccinator; and vaccination is gratuitous for all desiring it. There is a central establishment for the collection and distribution of vaccine lymph. In other respects the law as to vaccination is identical with that for England.

Hygienic Regulations as to Schools.—In addition to the sanitary regulations contained in the Public Health Act and in local bye-laws, the regulations under the Education Act of 1872 comprise the following details as to school hygiene:—

Schools should be placed in a healthy neighbourhood, as far as possible from noise, and having an uncovered area of at least 1,200 square yards.

Each school should be well lit, kept thoroughly clean, heated during cold weather, properly drained, well ventilated, etc.

In the class-rooms each pupil must have at least 75 cubic feet of air-space, and 8 square feet of floor-space; in schools constructed since 1874 each pupil should have 100 square feet of floor space. Lately 140 cubic feet have been required, the preceding amount not sufficing for efficient ventilation.

The State gives grants for the construction of school buildings, and for their annual maintenance. The payment of these grants is made dependent upon the carrying out of the official regulations.

General Police Act for Scotland, 1862.—The object of this Act was to regulate the administration of the finances and sanitary operations of small towns which have no police office, and of villages with more than 700 inhabitants. The regulations contained in it are in part embodied in the Public Health Act (Scotland) of 1867; others, especially the most detailed, are still in force. Its principal dispositions relate to lighting, to the cleansing and paving of streets, to drainage, the provision of domestic water, etc. The most important of these provisions are as follows:—

Every owner is required to distribute water in his house by means of pipes at least $4\frac{1}{2}$ inches in diameter.

Sinks and their waste pipes ought to be so arranged as to avoid obstruction.

The yard, street, etc., around a house should be cleansed three times a week.

The stairs and passages of a house should be well ventilated, and whitewashed or painted as often as required by the authority. The tenants are bound to wash and sweep the stairs and entrances of their tenement at least once a week. The house-refuse must be removed by the Local Authority at the cost of the owner.

In churches, theatres, and other places of public assembly, the ventilalation should be of a satisfactory character. For this purpose, a plan should be submitted to the Local Authority for approval before beginning the erection.

Poor-law Regulations, etc.—In Scotland a good organization of public poor-relief is regarded as an essential condition of a properly constituted sanitary service. Each district is bound to provide for its own paupers, the cost being defrayed out of the poor-rate and subsidies from the State. Poor-law relief being regarded as one of the most important questions of the social organization, the State has under its control and surveillance the discharge of the duties of local Boards of Guardians. The State help is given in the form of annual grants and of redeemable loans at a minimum rate of interest, for erecting hospitals, asylums, etc. The districts thus receiving State help for poor-law administration are subject to certain regulations, principally the rendering of reports and accounts which cannot be demanded from districts not receiving such help.

The obligations of districts to the central government relative to the sanitary condition of the poor are as follows :—

Districts not subsidised by the State. All paupers requiring medical help must have the attention of a doctor, and if necessary, receive medicine and all appliances required free from charge.

The relieving officer is required in addition to furnish to the sick and to convalescents, any nourishing food, clothing, lodging, and bedding that may be required, on the certificate of the medical officer in writing that such things are necessary. If the relieving officer on his own responsibility declines to furnish the necessaries ordered by the medical officer, he must without delay inform the Board of Guardians, who will decide the matter.

The medical officer who is paid for this work ought personally to attend to the sick poor in his district, and if necessary must visit the sick at home. He is personally responsible for the acts of any assistant sent by him.

Districts subsidised by the State.—Every district receiving a grant from the State for poor-relief, should appoint one or more district medical officers, with a fixed annual salary.

The medical officer is required to give to the sick and old in his district

medical help on the receipt of an order from the relieving officer. He is also required to keep a daily register of the poor treated by him, which must be presented at each meeting of the Board of Guardians, and is subject to inspection by the inspector of the Board of Supervision. The medical officer must also furnish any information required by the Board relative to the sick poor. When a disease is prevalent among the poor, the medical officer should furnish written information of it to the Local Authority. He ought if required to attend the meetings of the Board of Guardians, and to give certificates of the nature of any case of disease. The medical officer cannot at the same time hold the appointment of relieving officer, or have the right to vote in meetings of the Board of Guardians.

Specimen of sick register for paupers.—The preceding regulations for succouring the sick poor are registered as follows :—

Register Number *Age*	*Name* *Abode* *Name of Disease*
Date of Visits.	Treatment.

Regulation of Dairies, Cowsheds, and Milkshops, 1885-87.—The Contagious Diseases (Animals) Act, 1878, conferred on the Privy Council the power of making and publishing such general and special orders as they considered necessary on the following points :—

(1) For the registration with the Local Authority of all persons carrying on the trade of cowkeepers, dairymen, or purveyors of milk ;

(2) For the inspection of cattle in dairies, and for prescribing and regulating the lighting, ventilation, cleansing, drainage, and water supply of dairies and cowsheds ;

(3) For securing the cleanliness of milk-stores, milk-shops, and of milk-vessels used for containing milk for sale ;

(4) For prescribing precautions to be taken for protecting milk against infection or contamination ;

(5) For authorizing a Local Authority to make regulations for any of the preceding purposes.

The Privy Council in 1885 issued in accordance with the above, *The Dairies, Cowsheds, and Milkshops Order*, 1885, having the force of law in Great Britain. In 1886 the Contagious Diseases (Animals) Act, 1886, transferred the powers of the Privy Council to the Local Government Board for England and to the Board of Supervision for Scotland. The latter published in 1887 *The Dairies, Cowsheds, and Milkshops Amending Order*,

1887, which regulates the control of these in Scotland. It contains the following regulations :—

Registration of Milksellers.—Only those whose names are registered by the Local Authority have the right to sell milk, with the exception of those who sell milk exclusively to their own workpeople or near neighbours, or who use their milk for making butter or cheese. This registration is done in accordance with the following form :—

THE CONTAGIOUS DISEASES (ANIMALS) ACTS, 1878 & 1886, AND THE DAIRIES, COW-SHEDS, AND MILK-SHOPS ORDER, 1885.

To the Local Authority of.....

The undersigned applies to be entered on the official register.

Name of Applicant. Occupation. Abode.	
Situation of Buildings.	
As Cowkeeper. Milkman. Milk-seller.	

Signature of Applicant.....

Place and Date .....

Persons selling milk in the streets are subject to the same regulations.

Rules for Local Authorities.—In addition to the preceding general regulations, Local Authorities can make detailed regulations as to the preparation and sale of milk. These should be published in the local newspapers. Local Authorities may modify or annul such special regulations, public notification being given of such changes.

Methods of Inspection.—The Local Authority appoints an inspector to supervise the carrying out of the regulations, the sanitary inspector generally performing this duty. Every breach of the preceding regulations renders the offender liable to a maximum penalty of £5.

Other Sanitary Laws.—The following laws are the same in Scotland as in England :—

Rivers Pollution Prevention Act, 1876.
Sale of Food and Drugs Act, 1875–79, *with some immaterial exceptions.*
Bakehouses Regulation Act, 1863.
Alkali Acts, 1863–74.
Factories and Workshops Act, 1878–83–91.
Coal Mines Regulation Acts, 1872–75.
Housing of the Working Classes Act, 1890.
Quarantine Regulations.
Merchant Shipping Acts, 1867–76.

Registration Acts.—This law has been in force in England since 1836, in Scotland since 1855.

Results produced by the Sanitary Laws.—In Scotland the sanitary laws are not sufficiently strictly observed, some districts, especially in the north, having no sanitary inspector. There are not lacking, however, proofs that great progress has been made since the adoption of the Public Health Act of 1867.

In 1870, three years after its adoption, the expenses for sanitary work had risen to £13,371, in 1881 to £234,290.

In 1870 the provision of water supplies cost £8,700, in 1881 it had risen to £94,378.

Between 1867 and 1881, Scotland spent £1,560,133. In this total the sewers cost £197,473, water-works £518,800, and isolation hospitals £224,711.

These figures only include special expenditure in the sanitary service caused by the Public Health Act of 1867, and not the ordinary local sanitary expenditure. The contributions for the sanitary requirements of the towns of Scotland, had risen in 1881 to £291,500, of which £31,872 was spent upon sewers, £244,229 for water supply, £41,585 for divers purposes, and £14,325 for cemeteries.

The sanitary budget of Scotland in 1883 amounted to about £911,460 for a population of 3,825,744, or about 4*s.* 9*d.* per head. This is still considered too little, and more is required. A good state of public health is regarded as the basis of general welfare, as expressed by the dictum, "Public Health is public Wealth."

The investigations made to discover the causes of the neglect to apply the sanitary law in certain localities, have led the Board of Supervision to make the following general observations:—

"The reason for this apathy in a large number of rural districts, is the idea that the sanitary laws are not obligatory, and that consequently one need not concern oneself with the removal of nuisances if not willing to do so. It is clear that such persons should be compelled by legal measures to abandon this false notion. Another important cause is, that the local poor-relief guardians are generally not competent to exercise control over the public health. Oft-times incapable of appreciating the fatal effects of insanitary conditions in the propagation and aggravation of contagious diseases, they oppose all expenses which would be the means of ending a state of things dangerous to health. Habituated to living in such conditions, they cannot realize their dangerous character. In like manner the Local Authorities draw back with fear of raising discontent at the expenditure involved in sanitary reforms. The men who, without allowing themselves to be intimidated by public discontent, take the measures necessary for the public good, are in a small minority. When this discontent carries with it loss of employment, it is still more difficult to ensure the complete discharge of duties."

The influence of public hygiene in lowering the death-rate is seen in a

comparison of the rural districts with the eight principal towns of Scotland. During the ten years 1869–78 the mortality diminished by 12 per cent. in the towns, in which there are energetic and intelligent Sanitary Authorities, and increased by 4 per cent. in the rural districts; giving conclusive proof of the injurious consequences of inattention to sanitary laws.

CHAPTER II.

EDINBURGH.

General Review.—Divisions of the Town.—Organization and Sanitary Legislation.—Sanitary Provisions as to the Air.—Sanitary Provisions as to Water.—Sanitary Provisions as to Food.—Sanitary Regulations as to the Soil.—Scavenging.—Sewerage. Byres.—Abattoirs.—Measures against the spread of Infectious Diseases.—Vaccination.—Isolation and Care of the Sick.—Disinfection and Burial.—Prostitution.—Public Buildings.—Workmen's Buildings.—Industrial Hygiene.—School Hygiene.

General Review.—The magnificent capital of Scotland is situated on the south side of the Firth of Forth. Between it and the sea is the town of Leith, which serves as its port.

The soil is very hilly. Within the city on the east rises the Castle Hill (384 feet high), with its ancient and famous castle; on the west is Calton Hill (302 feet high). Near Edinburgh on the south-west, rises Arthur's Seat (787 feet high), which is prolonged into the Pentland hills (1,805 feet high), stretching inland for a distance of eighteen miles.

The city occupies an area of about 30,000 square yards; two valleys running east and west divide it into three parts. To the south, and on the sides of Castle Hill, is the old town. It is of great interest to the historian and archæologist; to the hygienist it is a subject for serious meditation how to satisfy the demands of sanitation without interfering with venerable historic remains.

The valley limiting the old town on the north, is in great part covered with magnificent gardens (*Princes Street Gardens*), containing a superb monument of Walter Scott, and statues of other illustrious men. On the other side of the gardens is the new town, founded in 1768, and situated on a plateau, which ends at Calton Hill. On the north, the new town is bounded by a valley traversed by the stream, the *Water of Leith*, whose steep borders covered with gardens present a picturesque view. On the north of the Water of Leith is a modern, well-built suburb.

The greatest extension of the city has taken place on the south side, where the great suburbs of Newington and Morningside are found.

In 1891 the population of Edinburgh was 261,970, or about 350,000 including the population of Leith. Leith is a port with a sanitary organization and administration separate from that of Edinburgh.

The lowest parts of Edinburgh are 98½ feet, and the highest parts 200 to 250 feet above the level of the sea.

Edinburgh is neither strictly a commercial nor an industrial town. It is an artistic and scientific centre. Printing and the professions associated

with it constitute its chief industry. Its university and faculty of medicine are the most renowned in Great Britain; and it also contains a large number of schools of various kinds.

The climate is pleasant; the mean humidity of the air for the year averages 65 per cent.

The death-rate was under 19 per 1,000 in the period 1885–8, but in the last two years slightly higher, owing to the fatal prevalence of influenza.

The following figures show the influence of sanitary improvements:—

In 1863	the death-rate	was	25·8	per 1,000.
„ 1875–79	„	„	21·7	„
„ 1880–84	„	„	20·0	„
„ 1885–88	„	„	18·8	„
„ 1889–91	„	„	19·8	„

Divisions of the Town.—Edinburgh is divided into three sanitary districts—Old Town, New Town, and Southern Suburbs, which are identical with the divisions for poor relief.

In order more effectually to regulate the sanitary service, Dr. Littlejohn, the very active medical officer of health, has divided the town into nineteen sub-districts, and has collated information on the healthiness not only of each sub-district, but also of each street, and each house. The statistical information is available for the last twenty-five years. The practice has arisen of not hiring a house until informed of its healthiness by the Board of Health; and consequently owners are impelled to put their houses into a sanitary condition.

Organisation and Sanitary Legislation.—The sanitary service is directed by a separate department, with the medical officer of health at its head. It contains also a clerk and three sanitary inspectors. The instructions for these employés are the same as in England. The surveyor or engineer also forms part of the sanitary service, but he has a separate department, consulting when necessary with the sanitary department.

The supervision of the carrying out of the sanitary laws belongs partially to the police. The chief inspection of common lodging houses is made by the senior lieutenant of the police, and so on. The Town Council exercises final control over the more important questions of the sanitary service.

In addition to the general sanitary laws, there are municipal sanitary regulations, which are contained in the *Edinburgh Municipal and Police Act of* 1879, in the *Edinburgh Slaughter-houses Act*, 1850, *Edinburgh Markets and Customs Act*, 1874, etc. These Acts contain among other clauses, powers to secure the compulsory notification to the medical Officer of Health of each case of the chief infectious diseases, anticipating the powers of the Infectious Disease (Notification) Act of 1889.

Sanitary Provisions as to the Air.—The conditions regulating the hygiene of the atmosphere in different parts of the town differ more than those on any other point, owing to the steep character and the varying age and character of buildings in different parts of the town.

The old town on the sides of the Castle Hill, which at the beginning of this century was still surrounded by walls, has no public gardens or parts planted by trees. The houses are crowded and often without yards.

The height of dwellings, some reaching to ten storeys, is an essential obstacle to the penetration of sun and air to the bottom of the street. Moreover, these houses, formerly occupied by the nobility, are now nearly exclusively occupied by the poorest classes, rendering still more difficult the purification of the air in this quarter.

Nevertheless in recent years, by widening streets and removing a considerable number of houses, the sanitary conditions have been greatly improved, as shown by the lowered general mortality, to which other sanitary improvements have contributed.

The inhabitants of Great Britain, much more than other people, have a fair conception of the importance of ventilation, thus obviating some of the dangers from the bad construction of houses. Even in cold weather the windows of high houses are opened, children and adults, without fear of chill, breathing the pure air.

The old town is surrounded on three sides by spacious open places. On the north the magnificent *Princes Street Gardens* stretch from east to west, across the town; on the east is the *Queen's Park*, near Holyrood

FIG. 61.—SECTION OF

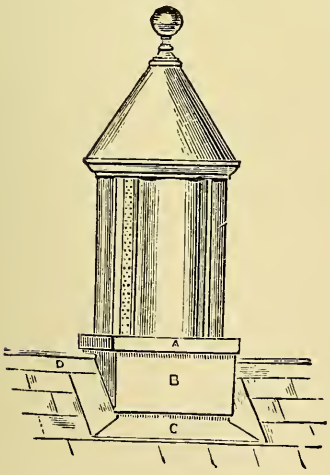


FIG. 62.—ELEVATION OF

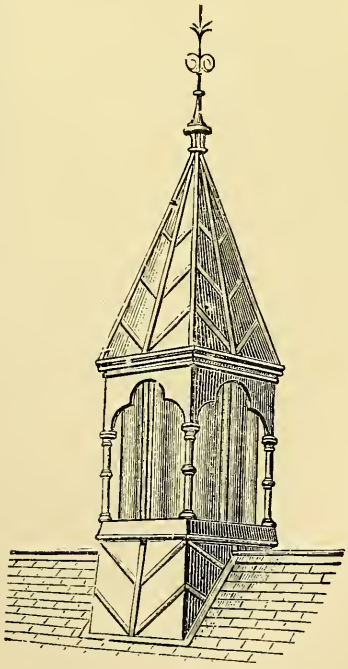


FIG. 63.—ANOTHER ELEVATION OF

BUCHAN'S VENTILATOR.

Palace. This park is continued on the heights of *Arthur's Seat*, which is surrounded by a handsome promenade, *Queen's Road*. To the south, are immense meadows for public recreation in the open air—horse exercise for the rich, and football for those less favoured by fortune.

The new town, occupied by the upper classes, possesses large and airy streets, intersected by open spaces, crescents, and squares, well planted with trees and grass. There are pleasant promenades in different parts of the banks of the *Water of Leith*, and the imposing Calton Hill lies to the east of the New Town.

In the suburbs houses are more scattered, having gardens, and giving the inhabitants a taste of the pure and fresh air of the country.

In the New Town the houses are never higher than the width of the street, and usually not so high. The erection of houses without proper yard space is forbidden. The houses, as in the rest of Great Britain, are not very high, being only intended for one family. Each must have an open yard behind; consequently there is behind each group of houses a large open space, divided from each house by walls about six feet high.

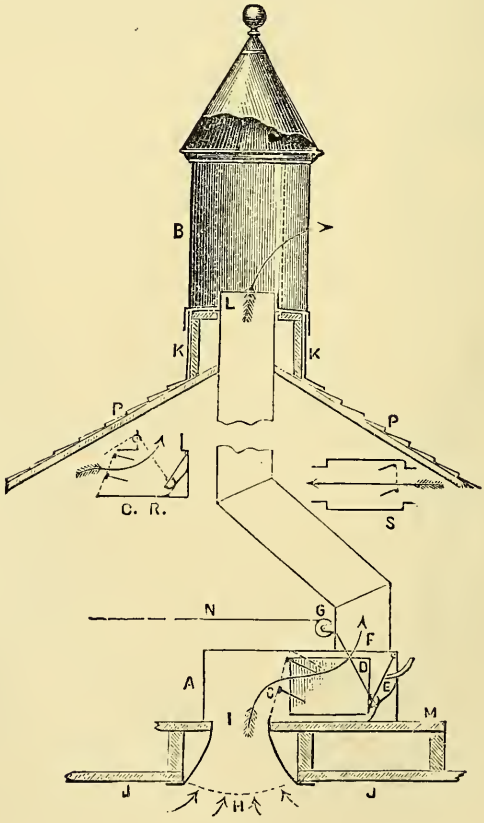


FIG. 64.—BUCHAN'S VENTILATOR WITH THE ANTI-DOWN DRAUGHT VALVE-BOX.

These open spaces are often laid with grass, with or without trees, and are very well kept.

The ventilation of houses in Scotland is the same as in England, the improvements being common to both. An apparatus similar to Boyle's air-pump ventilator is the *exhaust-ventilator* of Buchan, of Glasgow.

Fig. 61 is a section of the ventilator shown in Fig. 62 ; its base A rests on a wooden frame B, placed on the ridge C.

It is much used for the ventilation of churches, assembly rooms, schools, hotels, hospitals, etc. Fig. 63 shows a more ornamental form of the same apparatus.

In order to prevent any down-current of air, and the inconveniences arising during the cold season, or from strong winds, Buchan has constructed an *anti-down draught valve-box*, which can be connected with his ventilator, as shown in Fig. 64. B is the Buchan's exhaust-ventilator, placed on the framework on the ridge. L F is the discharge-pipe for foul air, coming from the valve-box A, placed on a board above the rafters ; J is the ceiling. C are the valves which automatically close, and are so balanced as to open with the most feeble current of ascending air, and close with a current of descending air. D is a pane of glass on each side of the box A to enable the action of the valves to be seen. E is a plate of a certain weight, to which is fixed a cord N, moving on the pulley G. By this means the ventilator can be closed if desired, and the current can be regulated.

The relative size of the orifice H, and of the discharge-pipe L, are generally such that the diameter of the first is double that of the second. The proportion diminishes for pipes more than 6 ins. in diameter.

The amount of ventilation depends on the force of the wind, and the difference between the internal and external temperature. Buildings fully exposed need much less ventilating apparatus than others built in narrow streets. For churches containing more than 300 persons, one allows for each person an outlet of 24 square inches. Many small outlets are preferable to one large one. They can be made to converge to one outlet. In this case the diameter of the chief tube can be less by one-quarter than the sum of the small tubes. For single storeyed buildings it suffices to have ventilators on the ridge without discharge-pipes. If it is desired to have a valve-box, a tube from two to three feet long is required. The valve-box is fixed as shown at O R in Fig. 64.

For schools, small churches, and assembly and other rooms which are used daily for a considerable time, the outlets should be $\frac{1}{2}$ to $\frac{3}{5}$ square feet in area for each person.

In hospitals where each person is allowed 1,400 to 1,700 cubic feet of space, twelve to sixteen times more area for discharge of air should be required than in schools.

For ordinary rooms, outlet shafts with a sectional area of 24 square inches for each person should be provided.

Another ingenious apparatus is known as *Honeyman's Ventilator* or

Diaphragm, invented by the celebrated church architect, John Honeyman, of Glasgow. In construction as shown in Figures 65 and 66, it consists of a long box placed horizontally between the ceiling and the upper floor, and communicating with the external air at two opposite free walls. It can also be fixed above the ceiling, to open on each side of the roof, reaching from one ridge to the other.

The bottom of the box slopes to the exterior, and is covered with lead and zinc, so that rain easily drains off. In the box, communicating with the aperture from the room, is the diaphragm.

Fig. 65 shows a diaphragm suitable for ventilation above the ceiling. Fig. 66 shows the same adjusted in the ceiling. When the wind blows into the ventilator at A, the valves B become closed; the air passing by the opening D, becomes augmented in rapidity, and produces an ascending current towards the exterior E. The air of the room is thus aspirated through F. The valves are of oiled silk, so arranged that they are open when the air is calm, the impure air from the room then escaping on both sides.

This ventilator presents several advantages. It can be fixed without the necessity of external decorative arrangements. It has a large outlet-opening without causing down-draughts of air. Unlike other ventilators, in which currents of air are produced in small tubes by the action of the wind on large tubes, here the current is produced in a large tube by the action of the wind on a small one.

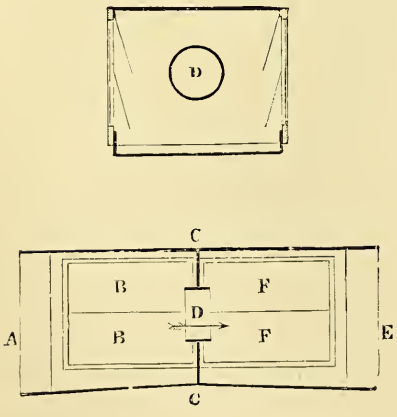


Fig. 65.

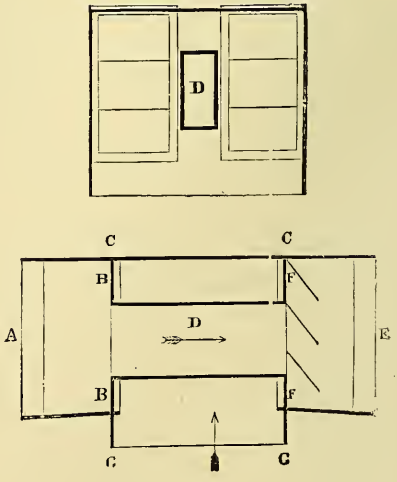


Fig. 66.

Honeyman's Ventilator.

Sanitary Provisions as to Water.—Edinburgh has had a central system of water-supply since 1681. Up to that date the town supply was derived solely from the springs at the back of Castle Hill, and even to-day

a large number of these are used. Formerly the water was brought to the neighbourhood of the town from these in wooden pipes.

The Water Company was founded in 1819, its water being derived from the Crawley springs in the Pentland Hills. As these were insufficient, the Company has constructed an aqueduct, bringing the water of Morfoot Hills a distance of thirty-seven miles. The water coming from hills 2,150 high, there is no necessity for pumping.

The water thus furnished is however muddy, especially in the rainy season, and requires filtering. The filtering beds at Colington are about three miles south of the town.

The water, brought in cast-iron pipes, is received at Colington into a large collecting reservoir, whence it is conducted into filtering beds, and afterwards into a reservoir, from which it supplies the city. Colington is so much higher than Edinburgh, that the highest points in the city, including the old castle at the summit of Castle Hill are supplied by simple gravitation. The filtering medium is formed, as usual, of several layers of stone gradually decreasing in size, of gravel, and finally of sand. The stones form the lowest stratum.

Foreign particles are arrested in the upper part of the sand, this being removed from time to time, and renewed by the addition of pure sand, when it has become much thinned. The process of cleansing is tedious and costly, as the sand is removed by hand and barrow, thoroughly cleansed, and then replaced. Each filtering bed having a superficial area of 3,588 square yards, it will be understood that large quantities of sand require to be removed at each cleansing.

The method of washing and purifying the sand, employed at Colington, is very simple and practical. Over the orifice of a pipe which brings the water from the collecting reservoir to the filter is placed an iron box so adjusted that the orifice of the pipe is at the bottom of the box. Over this orifice is fixed a kind of strainer, through which the water passes in jets. The box is two metres long and one metre wide. One of its short sides is a little lower than the others.

The box is partially filled with the dirty sand and the tap turned; the water coming from the bottom stirs up the sand, and thus washes it. The fouled water escapes by the lowest side of the box, and is removed by canals. To ensure equal purification of the sand, it is stirred from time to time in the box. There are two similar pipes in each filtering bed to enable the transport of the sand to the box to be easily carried out. Great economy of working is effected by this method of cleansing the sand.

The waste water from the sand-washing has also been utilised, being collected into two reservoirs, and used for irrigating fields at a lower level.

No house is allowed to be built in Edinburgh without a supply of water being laid on to it. In the poor quarters, where there are several families in one house, taps are placed on the landing on each storey.

In the streets and public places are a large number of fountains with

cups for supplying drinking water. A considerable number of old wells are still used.

The water-rate is paid by the owner of each house, and is reckoned on its rental. Thus a too economical consumption on the part of tenants is

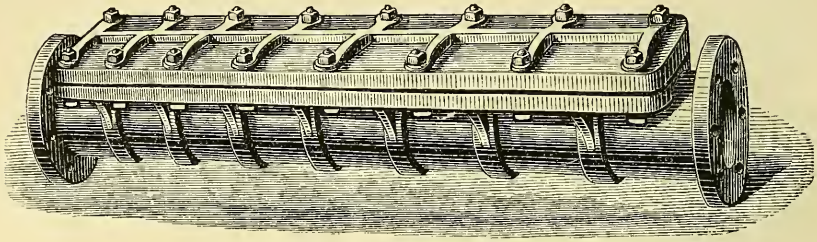


Fig. 67.—Glenfield's Box for Cleansing Water-Pipes.

avoided. Water-meters are not permitted. Experience has shown that incrustations and deposits of dirt in time form in water-pipes causing obstruction in them. Figures 67 and 68 show a very ingenious apparatus designed by Glenfield and Co., of Kilmarnock, for the cleansing of large iron pipes. At each bend of the pipe a pipe of the form shown in Fig. 67 is adjusted. When it is wished to cleanse this, the cover is lifted and the apparatus shown in Fig. 68 is introduced, with its extremity pointing in the direction of the current. The cover is then closed, and the pressure of water drives on the apparatus, which in its course scrapes off the deposits.

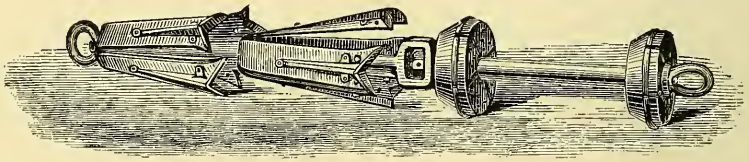


Fig. 68.—Glenfield's Apparatus for Cleansing Water-Pipes.

This apparatus is used in several parts of Scotland.

For smaller pipes, the same house has constructed a simpler apparatus, a sort of oval shovel of sheet-iron, of the shape of the pipe, and fixed to it by a spring. By means of a wooden handle this can be pushed backwards and forwards to scrape off deposits.

Sanitary Provisions as to Foods.—As already stated, the *Sale of Food and Drugs Act* is in force in Scotland. One of the most important duties of the sanitary inspectors of Edinburgh is the control over the observance of this Act, and of the power conferred by the Public Health Act as to the seizure of unsound and diseased food.

In addition to these general powers, the measures against the sale of meat from diseased animals are here more severe than in any other part of the world. Slaughtering can only be carried out in the public abattoir for the city and a radius of two miles.

The animals are examined before slaughtering, and the meat afterwards. All flesh of diseased animals is destroyed, or treated so that it cannot be used for food.

For animals found at the abattoir to be affected with pleuro-pneumonia, the owner is compensated to the extent of three-fourths of their market value.

Foreign meat is required to be conveyed to the abattoir, and examined before being exposed for sale. The owner of each carcass or part of a carcass pays at the abattoir the same impost as if the animal had been killed there. He is not allowed to bring the hide, horns, or hoofs into the town.

These regulations rendering imported meat dearer than that slaughtered in the town, have secured the desired end, that as a rule, living animals are brought to the slaughter-house, thus ensuring the most complete supervision.

The flesh of pork is not specially examined for trichinæ—either in Edinburgh or London. Pork is eaten well cooked, and cases of trichinosis have not been discovered. The sale of meat is unrestricted, but the storehouses and shops are under rigorous sanitary inspection.

Besides the preceding regulations, the sale of milk is under the following restrictions: All places intended for the sale of milk must be approved by the Sanitary Authority. All cases of infectious disease in the family of the milk-seller, or among his servants must be notified; and the orders then given to prevent the spread of disease must be carried out.

The sanitary inspectors supervise the sale of milk. They take from time to time samples of milk for analysis by the public analyst, as prescribed by law. This officer receives an annual salary of £100, with an additional sum for each analysis done in his laboratory.

Sanitary Regulations as to the Soil.—Scavenging.—In Edinburgh, as in every place where perfection is aimed at, the Sanitary Administration has control over the construction and cleansing of streets and public places. The principal streets are generally paved with stone; the most recent are of wood laid on cement, as in London. The branch streets are, as a rule, macadamised. Along the course of tramways, asphalte is employed.

The footpaths of the principal streets are of granolithic material, a sort of artificial stone in blocks 3 to 6 feet square.

The principal streets are cleansed in the early morning, and mud is removed along with other filth. In the other streets, cleansing may be done later in the day.

Household refuse is removed daily. Dustbins are forbidden to be kept in houses. The dustbin is placed in the street each evening, and emptied early the next morning. The refuse is removed in carts either to the public abattoir to be mixed with the ordure from that establishment, or to a depôt beyond the town near a railway line by which it is conveyed into the country.

Sewerage.—Since the beginning of 1860, Edinburgh has had a complete system of sewers. In accordance with the local regulations, each

house in the town must have its sewage and waste-water conveyed into the sewers. The slope of the ground is very favourable to drainage, the two valleys which divide the city sloping towards the sea. Thus the sewers of each part of Edinburgh can easily be conveyed towards collecting sewers.

The principal collecting sewer, following the valley to the north of the old town, goes to the irrigation farm at Craigentinny, which is a private enterprise, the proprietor of the farm having made a contract with the Sanitary Authority.

The arrangements are very primitive, the sewer when it has left the town becoming an open channel, which conveys the sewage to the fields. Here it ramifies into a large number of small canals, which spread the water on the soil. At certain parts, the lateral streams are furnished with sluices, to enable the water to be directed to special parts of the fields; the excess flows into the sea. In the neighbourhood of the town are other fields irrigated in the same manner by the contents of other sewers.

In the other valley which divides Edinburgh flows the Water of Leith. This stream formerly received the sewage of the parts of the town sloping towards it. It is now received into a great collecting sewer of cast-iron, which conducts it directly to the sea, about half a kilometre to the south of the new docks of Leith. This sewer opens into an intercepting reservoir, at a sufficient height to allow of the sewage flowing away freely, even at high tide. From this reservoir a pipe is carried along the bottom of the sea to low-water level.

The sewers of the town are mostly of glazed earthenware, the form of which has been improved in recent years. Figures 69 and 70 represent two modern types made by Buchan.

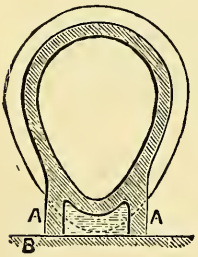


Fig. 69.
Section of an Elliptical-ribbed Sewer.

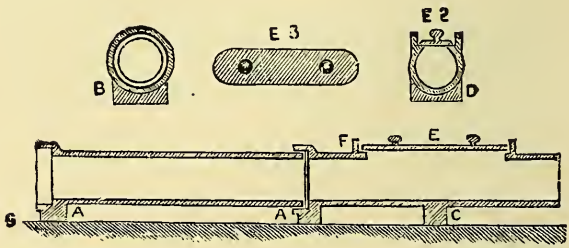


Fig. 70.
Sections of a Cylindrical Sewer.

Fig. 69 is the section of an egg-shaped ribbed drain-pipe. We know that the rapidity of the current is more uniform in oval than in cylindrical pipes, even when the quantity of water is less. They also require less water for cleansing. The ribs AA serve to keep the pipe in a fixed position. The space between them is either filled with cement to render the pipes more solid, or with gravel, which serves to dry the soil. Cylindrical pipes are constructed with similar supports. Other pipes have supports like those seen in Fig. 70 which keep the joints in place, the pipes and their supports being in one piece.

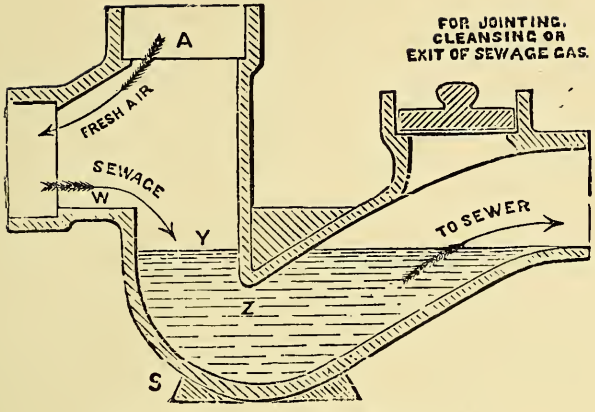


FIG. 71.—BUCHAN'S INTERCEPTING TRAP.

The oval opening with cover E 18 inches long enables the drain to be cleansed. The cover is cemented down to the pipe, so as to close it hermetically.

The drains for surface water from the streets empty into the sewers. At the street-level, they are furnished with a grating which prevents the entry of solid matters.

The sewers are ventilated by grids in the streets, or in some parts by shafts carried up the sides of houses above the roof.

The general arrangements of waste pipes are as described at pages 78 and 103. As we have seen (p. 83) all waste-pipes and house-drains should be trapped from the sewers. Intercepting traps between the drain and sewer are shown in Figures 71 and 72, the inlet ventilation for the house-drain has been shown at A Fig. 17.

These syphon-traps are after the model of those proposed by the Local Government Board (Fig. 17 A), but differing in the fact that the descending arm of the trap is vertical, thus forming an acute angle; hence the name of *cascade-action drain-trap* sometimes given to it.

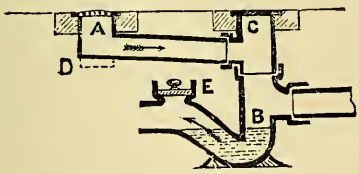


FIG. 72.
BUCHAN'S INTERCEPTING-TRAP.

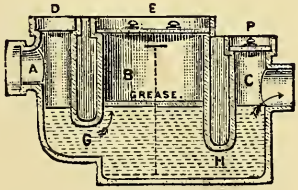


FIG. 73.
GREASE-TRAP.

Fig. 73 shows a section of a grease-trap. It is adapted for receiving the waste-water from kitchens, and for intercepting the fat, which frequently on solidifying becomes deposited inside drains finally causing their obstruction.

Water-Closets.—In all well-to-do dwellings in Edinburgh, water-closets are used. These are like the English closets in all practical points.

Valve closets, wash-down and short-hopper closets are also in use, and as in England appear to be gradually superseding the wash-out closets.

In workmen's dwellings in Edinburgh, each family cannot have its own special closet; and in some of the old houses there is no yard in which the closet can be placed.

In these dwellings pails or tubs are made use of, which are emptied each night, cleansed and disinfected.

All these houses have the street water-supply and an opening to the sewer; into the latter the pails are directly emptied, cleansed, and their nterior treated with carbolic acid.

Cow-Houses or Byres.—The custom in Edinburgh of keeping cows within the town doubtless goes back to the time when it was a fortified place. In 1863 the number kept in the town had risen to 2,015, and there was just cause for complaint of the resulting nuisance. Since then the inspection of cattle and the cleansing of byres have been carried out with such rigour that the number of cows has probably not increased, and the resulting nuisance has been reduced to a minimum.

The right of keeping cows within the town is subject, in addition to the general law, to the following regulations:—

All byres must be registered. Their size must be measured, and only the prescribed number of cows kept in them. They must be from time to time inspected by the superintendent of streets and buildings. If the floors or drains are defective in any respect, they must be repaired, after a notice to this effect.

Each byre should have a water supply for washing and cleansing. The dung-pit should be emptied daily.

Whenever a cow dies, the inspector should be informed, and it is his duty to inquire into the nature of the malady.

Pigs can only be kept at the outskirts of the town, and when the locality and all the arrangements are approved by the Sanitary Authority.

Abattoirs.—The public abattoir of Edinburgh is situated near Fountain Bridge, and faces on one side the canal which, running through the most fertile part of the country, connects Edinburgh with Glasgow.

The abattoir is enclosed by a high wall, and the public are not admitted to it. The site contains two parallel buildings, divided into compartments, each having a space where are placed the beasts intended for slaughter. The surface slopes outwards.

A channel running the length of the buildings carries off the waste water. Each compartment has its own water-supply, and is paved with granolithic slabs carefully cemented together.

The entire ground is paved with square stones.

In proximity with the abattoirs, there are:

1. Covered sheds for the cattle, the floor of which is strewn with a large quantity of peat as litter;

2. An isolated shed for sick animals, with a place for depositing their food;

3. A building for the treatment of guts, of fats, horns, hoofs, hides, etc.;

4. A drying place for the preparation of albumen (desiccated serum).

The preparation of this product is very simple, although the attempt is made to keep it secret. As soon as the blood is coagulated, it is divided into segments by a knife with a large blade, and placed in tin receptacles with perforated bottoms. The liquid serum passes then into a receptacle placed beneath, and is subsequently dried at a temperature of 40° C. The albumen thus obtained forms a valuable article of commerce employed in dyeing processes and in the manufacture of printed calicoes, replacing the dried white of egg which is more costly, but was formerly exclusively used for this purpose. The coagulated blood remaining after the separation of serum is conveyed into a special building.

5. This building is for the preparation of blood guano. Here is a steam boiler in which the greater part of the water contained in the blood is evaporated. The mass is then completely desiccated by steam, after having been spread out flat. The product is a powder employed as manure.

6. The office, near the gate of the abattoir, with rooms for the superintendent and veterinary officer.

The slaughtering is done as in London. The Jews also slaughter in the abattoir, according to their usual method, by making a large and deep incision across the neck of the animal.

Opposite each compartment are two barrows, one for blood, the other for the intestines and other non-utilisable parts. These are not allowed to be carried into the abattoir.

The refuse is carried to a place behind the abattoir, and placed in a tumbler-cart. When this is full, it is conducted to the depôt near the canal, outside the abattoir. A considerable amount of house-refuse is brought here each day from the town. This lies in beds 18 inches thick, and on it is deposited the refuse from the abattoir, which is then covered over with dry house-refuse. It is thus deprived of offensive smell, and is then immediately loaded on to the barges which convey it into the country, without a day's delay.

The annual rent for a single compartment in the abattoir is £8. Several butchers may combine for the hire of a single compartment.

Butchers may also kill in the abattoir, and pay a fixed sum for each animal slaughtered.

Measures against the Spread of Infectious Diseases.—Vaccination.—Vaccination is carried out in Edinburgh at three public dispensaries, where poor persons receive gratuitous medical treatment. Here also medical students are instructed in the practice of vaccination, which in Great Britain can only be done by a doctor.

Isolation and Care of the Sick.—In Edinburgh, of all cities of the world, the notification of infectious diseases has received the most

complete development. The powers under which this notification is enforced are contained in the Edinburgh Municipal and Police Act, 1879 :

" In order to secure the most effectual measures against the spread of infectious diseases, all doctors practising in the town are required, under penalty of a fine of fifty francs on default, within twenty-four hours to inform the medical officer of health of every case of cholera, typhus, typhoid fever, diphtheria, small-pox, scarlet fever and measles occurring in their practice, giving at the same time the patient's address." The doctor receives *2s. 6d.* for each notification of which the diagnosis is correct.

In order to facilitate the declaration, the medical officer of health is required to furnish each doctor with printed forms. These forms are supplied in books with counterfoils, stamped envelopes being also furnished. The forms are as follows :—

No.....

Case of .....

At .....

Declared.....

..... 18 .....

Edinburgh Municipal and Police Act.

No.....

To the Medical Officer of Health,

.....18.....

There is a case of ....

At .....

Age .... Sex.....

No immediate measures are necessary.

Name .....

The right portion of the form is detached and put into a stamped envelope having the printed address :—

Edinburgh Municipal and Police Act, 1879.

Dr. Littlejohn,

Medical Officer of Health,

Police Chamber.

The books of forms and envelopes are sent to each doctor with a letter in which the preceding paragraph of the municipal law is quoted, and which contains the following additional observations :—

" If any case requires removal to the hospital ; or if the dwelling of a patient or its surroundings, or any other circumstance appears to you to require the attention of the Sanitary Authority, it is only necessary to strike out the word ' no ' in the phrase, ' no immediate measures are necessary. As soon as this certificate is received, a sanitary inspector will take the necessary measures.

" If, on the contrary, you retain the word 'no,' it will be understood that you consider any action on the part of the Sanitary Authority inopportune or unnecessary. In this case, you will receive fifteen days later a request for information from the Sanitary Department as to whether you judge their assistance necessary or desirable for disinfecting the room and clothing of the patient."

As soon as a case of infectious disease is notified, the sanitary inspectors make careful inquiries into its probable origin. The question as to the connection of water-supply, milk-supply, or other foods, or contact with

other patients with the case is carefully investigated. The state of the house as to cleanliness, etc., is also investigated. As soon as practicable measures are taken to remove the cause of infection and prevent its spread.

Edinburgh has a hospital containing 200 beds for the treatment of infectious patients. This hospital is somewhat old, but thanks to its open situation, and the ample air-space allowed for each patient (about 1,800 cubic feet), it answers its purpose admirably. Its ventilation, as ordinarily in England, is by windows, of which the upper pane opens inwards, and by the fireplaces, which are on the principle of the Galton stove. There is also a system of heating by hot-water pipes, pure air being admitted over coils of these pipes.

The dejecta passed in bed-pans are disinfected by means of carbolic acid; those in water-closets are flushed by means of a discharge of three gallons of water. In the hospital there is a dry-heat disinfecting stove of an old pattern. It is cylindrical, of sheet iron; and in it are suspended wire baskets, full of articles requiring disinfection.

The medical attendant and his assistant reside in the hospital.

The care of the sick, as in all hospitals in Great Britain, is entrusted to a superintendent nurse with nurses under her.

The importance of isolation in infectious diseases has become so well recognised by the people, that even wealthy people solicit admission to the hospital. Each patient may arrange to be attended by his own doctor. The conveyance of patients to the hospital is carried out under the care of the Sanitary Department.

The other hospitals of the town have isolated rooms for suspected cases of infectious disease. As soon as the infectious character of a case is established, the person affected is at once transferred to the fever hospital.

Disinfection and Burial.—These are organised in accordance with the regulations of the sanitary laws, and present no special features.

Prostitution.—In Scotland, prostitution, as in the rest of the country, is subject to a preventive surveillance. By the Edinburgh Municipal and Police Act, females are forbidden to loiter and importune passengers. A first infraction of this regulation is punished by a fine, a repetition of it by imprisonment.

Females affected with syphilis are not subject to any constraint. The primary and secondary stages of this disease only rarely present themselves for treatment in the hospitals. The tertiary manifestations of the disease, on the other hand, are met with frequently. Cases so severe as those found in the English hospitals are but rarely observed.

Public Buildings.—The great hospital of Edinburgh, the Royal Infirmary, disputes with St. Thomas's Hospital in London the honour of supremacy from a hygienic standpoint among the hospitals of Great Britain. It was begun in 1870, and completed in 1879; the cost of its construction amounting to £400,000.

It has 660 beds, arranged in the three storeys of the hospital.

The hospital is built in a magnificent Gothic style, and consists of a central building and eight separate pavilions. Of these, four are placed two by two on each side of the principal building. The four others, placed 200 feet distant from the first, are separated from it by an open space traversed by a covered gallery which connects the two divisions.

The four pavilions near the central building communicate by means of covered corridors on two storeys. The other pavilions are only connected by a gallery on the ground floors.

Special buildings contain the post-mortem rooms, wards for isolating doubtful cases, and for cases of erysipelas, as well as rooms for the staff.

The pavilions are constructed like those shown in figure 5, page 61. The sick-wards are 95 feet long, 25 feet wide, and 16 feet high. Each ward contains 28 beds, so that each bed has a little over 376 cubic feet of air-space.

The ventilation and heating are on the same system as the Herbert Hospital and St. Thomas's (p. 157 *et seq.*). The fireplaces, however, are not in the centre of the ward, but against the walls.

The ground-floor is occupied by the kitchens, store-rooms, and dining-rooms of the staff, etc.

The food is cooked by the aid of steam, meat being roasted before the fire according to the English custom.

Between the pavilions and all around, large open spaces have been left as gardens, and for tennis and other games for the staff and convalescents. For the last there is also a large convalescent home to the north of Edinburgh on the hills of Corstorphine.

Workmen's Dwellings.—Since Edinburgh has ceased to be a fortified place, and has expanded as the population has multiplied, the wealthy families have abandoned the high houses and narrow streets of the old town; the poor taking their place. The narrower the streets and the more uncomfortable the houses, the less is their rental, and consequently the more they tend to be overcrowded by a poor population.

To ameliorate this state of things, some of the most dilapidated houses of the city were demolished, and replaced by workmen's dwellings more in conformity with modern requirements. These changes, however, have produced but little amelioration, as the houses being only built with a view to profit, the rooms were too small, the ventilation defective, etc.

Public benefactors then acted. As in London, considerable sums were given by private persons, and a society was formed for building good workmen's tenements. A large number of workmen's families thus found themselves in an improved condition; but the miserable dwellings which they left were occupied by still poorer persons.

These new tenements were unfortunately still too dear. Dr. Foulis, a generous philanthropist, therefore made a further attempt. He bought a group of houses in the poorest part of the town, cleansed and restored them, and transformed them into tenements for the very poor, which, though small, were very useful.

This was not all. The tenements were kept under supervision as to order and propriety, though much patience was exercised in this respect.

The good result of this experiment may serve as a model for other attempts.

There are in Edinburgh a large number of common lodging-houses, and there are few towns in which they are so well kept. Each bed is provided with two sheets and a mattress. A notice is affixed to the wall, "Smoking and spitting are forbidden." Suitable lavatories and water-closets are provided for each lodging-house.

The rental fixed by the authorities should not exceed $3\frac{1}{2}d.$ a day.

Industrial Hygiene.—The Factory and Workshop Act, as already stated, is in force in the whole of Great Britain. For facts bearing on this question, therefore the reader may refer to p. 168, *et seq.*

School Hygiene.—The regulations respecting this are given at p. 195. Their execution is supervised by the teacher, the School Board, the sanitary inspectors, and the medical officer of health.

BELGIUM.

CHAPTER I.

SANITARY ADMINISTRATION AND LEGISLATION.

SANITARY ADMINISTRATION.—SANITARY LEGISLATION.—Sanitary Measures in the Hands of the Government, of Provincial and of Local Authorities.—Special Regulations.—General Regulations as to Buildings.—Sale of Foods.—Factory Legislation. —Inspection of Factories.—Work in Mines.

SANITARY ADMINISTRATION.

THE chief Sanitary Authority in Belgium is the Minister of Agriculture, of Industry, and of Public Works. Next to him is the *Service de Santé et de l'Hygiène Publique*, whose function is to give advice on important matters concerning public health which are submitted to them, and to deliberate on all the hygienic questions to which it appears to them desirable to call the attention of the government.

The Conseil Supérieur was established by a royal decree of the 15th March, 1849, and modified by a decree of the 28th March, 1883. It comprises five medical men, one veterinary surgeon, three chemists, an engineer, an architect, and four public officials, who are nominated by the king, and appointed by the State. The Conseil is not a permanent medical committee, but a consultative authority whose members have at the same time other functions.

The *Royal Academy of Medicine* is another similar consultative authority, created by a royal order of the 19th September, 1841 ; its revised statutes have been approved by a royal decree of the 7th April, 1881. This Academy has to answer questions asked by the government, and to engage in all studies and research which can contribute to the progress of the different branches of medical science, especially therapeutics and hygiene. It comprises a section especially devoted to public health and forensic medicine.

Beyond these two consultative bodies, the law of the 12th March, 1818, has created at the head of and in each province a *Commission médicale provinciale.* The duties of these Commissions have been regulated in detail by the royal order of the 31st May, 1880. They watch over everything affecting the public health, and report to the competent authorities all infractions of sanitary laws and regulations. It is part of their duty to give instructions and advice on all questions concerning health which are asked of them by the Minister of the Interior, the provincial or judicial authority. If an infectious disease appears in the province, the president

ought immediately to visit the affected locality in order, in conjunction with the local administration, to determine the measures necessary to be taken. The president ought immediately to report the matter to the prefect at the head of the administration, stating his conclusions and the measures taken.

It belongs also to the Commissions to extend the use of vaccination, to exercise surveillance over manufactures, abattoirs, depôts for bones, rags, etc., which might occasion nuisance, and over the cleansing of public roads and of lodging-houses. When any stagnant water or pond is the cause of malaise or gives off offensive smells, the Commission can order it to be drained.

The Commission ought to send an annual report of its work to the Minister of the Interior. These reports contain the following divisions:—

1. Personal.
   - (*a*) In the towns; physicians, surgeons, pharmacists, veterinary surgeons, midwives, dentists, druggists.
   - *b*) The same for the country.
   - (*c*) The number of the above employed in proportion to population.
   - (*d*) Commission of local health.
   - (*e*) Corresponding members.
2. Investigations carried out.
3. Inspection of various establishments.
4. Surveillance over the carrying out of laws and regulations. Medical police.
5. Vaccination.
6. Epidemics and epizootics.
7. Sanitary state of the province and origin of diseases.
   Inspection of the Commissions of Health in the different localities of the province.
8. Medical topography.

The annual reports are analysed by the Superior Council, who present to the Minister their deliberations and propositions relating thereto.

Beyond the provincial Medical Commissions, there should be in each town and important locality a *Commission médicale locale.* This is the consultative authority in the hygienic questions of each town, and corresponds closely with the provincial Commissions. In localities not sufficiently important to organise commissions, there are corresponding members of the provincial councils.

The members of the local Commissions and the corresponding members are nominated by the king and paid by the State.

The *Charitable Associations* (*Associations de bienfaisance*) of Belgium are very important from a hygienic standpoint, and their great activity has given them a certain official character. They possess and maintain all the hospitals in Belgium, among others those of St. John and St. Peter at Brussels, which have been very costly. They also undertake all the

public relief, remunerate the doctors for the poor, and provide medicines for the indigent.

According to municipal regulations, all the doctors of the association ought to be approved by the municipal councils. The hospitals and establishments for relief of these associations are under the control of the municipal administration, and the State contributes a good deal towards their support. As all the public relief depends on their existence, the Conseils are obliged to create these charitable associations in localities where they do not already exist. Each year the government disposes of certain votes of money which it appropriates in part to the expenses of the sanitary administration, in part in subsidies to communities to aid them in the execution of sanitary work or in the prevention of epidemics. It possesses, beyond these, certain special votes for the carrying out of great sanitary works, which are applied in accordance with the recommendations of the Commissions de salubrité.

The government gives subsidies to communities for the following purposes :—

Measures to be taken in time of cholera.
The improvement of workmen's houses.
The construction and improvement of hospitals and asylums.
Public baths, inundations, cemeteries.
Prevention of hydrophobia.
Vaccination, establishments for animal lymph.
Participation in hygienic exhibitions and congresses.

Perhaps the most important result obtained by the government from these subsidies, is that each year exact and complete death returns are obtained from each district. The returns comprise the age, sex, the civil state and profession of the deceased, the symptoms of the disease, and the certificate of death from the doctor in attendance, as well as the circumstances which preceded and caused the death. It is evident that it is only by the knowledge obtained from such statistics, continued for a series of years, that we are able to take the necessary measures for the amelioration of the public health.

SANITARY LEGISLATION.

There is as yet no general Public Health Act in Belgium. The health of the country is regulated only by the old laws of the 14th November, 1789, the 16th–24th August, 1790, and the 28th September, 1791. The old French laws introduced into Belgium at the time of the conquest in 1794 impose on each community the enforcement of cleansing, the inspection of food, and provisions against fires, epidemics, and epizootics. From this cause the chief sanitary control is exercised through a great number of rules and regulations issued by the local authorities. In addition, there are special regulations for certain branches of hygiene, the application of which is entrusted to the government or to provincial authorities.

Sanitary Measures in the hands of the Government.—The law of the 19th July, 1831, gives to the State the power to inspect hospitals and asylums, and to take any steps which may be required by the actual invasion, or the fear of an epidemic. By the law enacted 30th December, 1882, the same powers are given in relation to epizootics. The government also regulates industrial hygiene; and according to the regulation of the 30th April, 1881, has charge of the security and salubrity of great rivers. The provincial Commissions are charged with the care of smaller streams. By the law of the 16th–26th September, 1807, it is the duty of the government to order the draining of unhealthy marshes. The law of the 26th September, 1876, empowers the government to issue regulations relative to the transport of poisonous and offensive matters, and to prevent their being thrown on the soil, in streams, canals, etc.

In addition, the central government has to approve and confirm certain regulations issued by provincial and local authorities.

Sanitary Measures in the Hands of Provincial Authorities.—It is the duty of provincial authorities to execute and watch over sanitary works, which concern more than one of the districts of the province. Their duty in this respect is indicated on page 221. In virtue of the law of the 7th May, 1877, the protection of non-navigable streams belongs to the provincial authorities. They ought also to make regulations forbidding the pollution of waters. The approval of provincial authorities is necessary in all projects of expropriation for improving insanitary areas (laws of the 1st July, 1858, 15th November, 1867, and 27th May, 1870).

Sanitary Measures in the Hands of Local Authorities.—Very exact regulations for the prevention of epidemic diseases are contained in the Royal Decree of the 1st March, 1888, which gives practical directions for the use of municipal authorities, and makes the notification of infectious diseases, and their isolation and disinfection obligatory. It has been already indicated that the old French laws of 1789, 1790, and 1791, impose on each township and district the regulation of its own sanitation.

They can for sanitary purposes take possession of houses or foul streams; but such local orders ought to be submitted to the provincial Sanitary Councils and to be authorised by the king.

The sanitary regulation of 1836 charges the local authorities with the supervision of prostitutes and places known to be frequented by them. In certain towns this regulation has led to a perfect supervision of prostitution.

The civil and penal codes of 1867 contain provisions relating to interments, giving the local authorities complete control over this matter.

Special Regulations. General Regulations as to Buildings.—Since the 1st February, 1844, general regulations respecting buildings are in force in all towns with more than 2,000 inhabitants. These regulations prohibit the erection or enlargement of a square, street, alley, or passage without the approval of the local authority, the provincial authority, and the king. No person is allowed to rebuild or alter his house without the permission of the chief magistrates and aldermen. Before the

commencement of every construction and alteration the plans must be passed. The decision of the authority ought to be given within fifteen days.

The civil code contains clauses relative to the rights of neighbours, and prohibiting the building of houses near stables, chemical works, etc.

Sale of Foods.—The provisions relating to the sale of foods are contained in the laws of the 19th May, 1829, of the 17th March, 1856, and in the penal code (8th June, 1857), article 454. This article punishes with imprisonment and fine any one mixing toxic or injurious matters with foods or drinks. Any one selling foods or drinks, knowing that they contain such ingredients, is subject to the same penalties. Any one having sold or exposed for sale adulterated foods or drinks is punishable in the same manner, but less severely.

All adulterated articles are to be seized and confiscated. Those which are injurious are destroyed, others are given to the charitable associations.

The law of the 1st August, 1890, contains several special regulations as to the sale of meat, coffee, flour, etc. The same rules apply for foods and drinks which have become impaired.

The municipal law of 1836 imposes upon local authorities the duty of appointing the necessary inspectors for the supervision of the sale of foods. By an enactment of the 20th September, 1883, the government has organized a special supervision of fairs and markets, to prevent the spread of contagious diseases of animals (law of the 30th December, 1882). The flesh of animals having died a natural death, or affected with disease, cannot be used for food, nor can the milk of animals affected with or suspected of rabies.

Belgium has no general law for the punishment of drunkenness, but local authorities are empowered to make their own regulations in this respect. Some local regulations forbid the supply of alcoholic drinks to drunkards and to infants.

Factory Legislation.—(*Royal decrees of the 29th January*, 1861, *27th December*, 1886, *31st May*, 1887.) Belgian legislation divides factories into two classes, each having two divisions.

In order to establish factories belonging to the first class, application must be made to the permanent committee of the Conseil provincial, who ought to consult the burgomaster and aldermen. To establish one of the second class, the permission of the last authority is necessary. The application in the first case should be accompanied by two plans, one of the locality of the factory or store, the other its position in relation to neighbouring houses, cultivated fields, roads, watercourses, etc., within a radius of 200 metres (class 1 A), of 100 metres (class 1 B), and of 50 metres (class 2 A). No limit is placed in regard to factories belonging to class 2 B. The application should state also the nature of the raw materials, the process of manufacture, the quantity manufactured, and the maximum quantity to be stored; and in addition the measures intended to be taken to preserve the health of the workers. With this object the government has issued the following form:—

	Number of Workers.		Hours of Labour.				Hours for Rest.	
			Time of commencement.		Time of leaving off work.			
	Day.	Night.	Day.	Night.	Day.	Night.	Day.	Night.
Men.								
Women.								
Boys under 16 years of age.								
Girls under 16 years of age.								

The heating, lighting, and ventilation of the rooms.
Method of cleansing of (*a*) the rooms, (*b*) the workmen.
Number of cubic feet of air for each workman in each room.
Means for securing doctors and medicines in the event of accidents.
Measures taken to prevent explosions and fire.
Measures taken against dust, and injurious gases and vapours.
Measures taken against accidents from machinery.
Other measures for maintaining the health of workmen, as change of work, meals, baths, water-closets, disinfection, etc.

The authority receiving the application, gives notice of the fact to the landowners and others interested within the stated radius; and they can make any criticism within fifteen days. The matter is then referred to an official, or to a competent committee, who give their report on the sanitary measures proposed. On the strength of this report, the establishment of the proposed business can be refused or sanctioned with or without conditions appended; such as regulations of the hours of work, exclusion of children below a certain age, etc.

The order respecting mines of the 28th April, 1884, forbids working in mines for boys under 12 years and girls under 14 years, and based on this the authorities, since 1886, have not permitted children under these ages to work in factories of the first class. Any complaints made should be based on the opinion of competent officials. The authority (provincial council or the government) receiving these complaints, should have them examined by other competent officials.

The license to establishments of the first class is only valid for thirty years, but it may be renewed. It can be withdrawn if the applicant does not observe the conditions laid down, or if he refuses to submit to any new regulations which the acting authority has always the right to impose. The same holds good if the work has not been begun in the prescribed time, or if the manufacture has been interrupted by an accident during the work.

Inspection of Factories.—The municipal Sanitary Authorities are charged in Belgium with the inspection of factories. The provincial council also supervises factories and their inspection by the local authorities.

Acting under the minister are inspectors of dangerous, unhealthy, and

unsuitable establishments, and a sanitary inspector. It is their duty to see that every one does his duty, and they have to attend to all complaints addressed to the government.

Steam engines and boilers are under the supervision of the mining engineers. A special inspector has charge of manufactories of chemicals. Metallurgic manufactories (furnaces, ironworks, etc.), are under the inspection of the mining engineers.

Factories situated along the course of navigable streams are under the supervision of the engineers of bridges and highways.

Work in Mines.—Work in mines is specially regulated by the law of the 28th April, 1884. It contains most complete hygienic regulations, as to plans of the mines; mode of arrangement of shafts; rules to be observed in descending and mounting; ventilation, lighting, and use of explosives; special arrangements for preventing accidents; and measures to be taken in the event of accidents.

The control and discipline of the staff and the inspection of the work are organized with the greatest care. One or two surgeons ought to be attached to each mine. No person can be admitted into a mine if drunk, or suffering from illness or infirmity.

No boy under 12 or girl under 14 years is allowed to descend or to work in a mine.

CHAPTER II.

BRUSSELS.

General Summary.—Organization and Regulations of the Sanitary Service.—Verification of Births and Deaths.—Demographical and Medical Statistics.—First Aid in Accidents.—Building Regulations.—*Necessity for permission to build, and rules regulating building.—Height of houses and rooms.—Courtyards, rain-water pipes and guttering.—Wells, cisterns, pits, cesspools, soakage-wells.—Water-closets and drains.—Dangerous Buildings.*—Regulations respecting Highways.—Regulations as to the Sale of Meat.—Sanitary Provisions as to Water.—Control of Foods.—Public Markets.—Scavenging Arrangements.—The Brussels Abattoir.—*General Arrangements.—Staff.—Inspection.—Slaughtering.—Triperies.—Fat-melting places.—Special Police Measures.*

Cattle Market.—Water closets, etc.—Drainage of Houses.—Public Sewers.—Collecting and Discharging Sewers.—Measures against Infectious Diseases.—Vaccination.—Notification of cases of Infectious Disease.—Isolation and Care of the Sick.—Disinfection.—Mortuaries and Cemeteries.—Prostitution.—Houses for the Working Classes.—School Hygiene.

General Summary.—Brussels, founded in the 10th century, is situated near the river Seune, an affluent of the River Escant. It comprises a lower part of the valley of this river to the north-west, and a higher part on the ground which rises gradually to the east and south.

Around the town proper and joined with it, are new suburbs, which were formerly villages. They have gradually become towns so closely connected with Brussels that it is impossible for a stranger to distinguish them. Still each of these suburbs has a distinct local authority, a fact which has been the cause of much embarrassment, particularly in sanitary matters.

In accordance with a clause of the laws of 1789 and 1790, which directs contiguous communities to take common measures against epidemics, Brussels and its suburbs make joint arrangements on sanitary matters, especially as to water supply and sewers.

At Brussels, as in other Belgian towns, the burgomasters and aldermen have charge of the municipal administration. The burgomaster has retained a power which is nearly as great as in the middle ages. He is the head of the entire administration, including the sanitary service. He alone has the power to order the destruction of insanitary houses, and to give authority for visiting private dwellings in the interests of health.

The burgomaster is in direct communication with the minister. For the carrying out of his duties, he has a large secretarial staff. He is helped by five aldermen, each the head of his own division.

The burgomaster and the aldermen are chosen from the inhabitants of the town for a period of four years, but can be re-elected. The elections are arranged, so that only a portion of the aldermen retire at each biennial period.

Since 1794 a *Communal Council* assists in the government of the town to decide questions of greater importance, to examine the budget, etc. The twenty-five members of this Council are elected for a time determined by the inhabitants of the town. The burgomaster is *ex-officio* president of the Council, and it is his duty to present each year a complete report of the administration of the town, including an account of its sanitary state, and of all sanitary work carried out during the year.

Organization and Regulations of the Sanitary Service.—Brussels posseses the most complete sanitary administration of any continental town. It is in the hands of a special authority, created in 1874, and called the *Service d'Hygiène*. This consists of a medical inspector the head of the department, an assistant medical inspector, five divisional medical men, five divisional medical substitutes, two assistant medical men, two medical inspectors of prostitution, an assistant medical man for the same purpose, a dentist for schools, a sanitary officer or inspector, and two disinfecting assistants. In addition to the above the police administration watches over the compliance with the sanitary laws, and counts among its officers experts specially charged with the control of food.

The clerical department comprises a head clerk and four other clerks.

The *Service d'Hygiène* possesses also a laboratory, with a chemist, a chief assistant, and a second subordinate.

The duties of the Service d'Hygiène are :

(*a*) To give certificates in the event of illness, or requests for leave of absence or retirement by the staff of the town ; to examine medically those who wish to enter into the service of the town ; to give medical help in the event of accident or sudden illness ; to supervise prostitution ; to watch persons suspected of being insane ; to give medical help to the employés of the police, of the water service, etc.

(*b*) To establish demographical and medical statistics.

(*c*) To watch over the hygiene of schools.

(*d*) To examine building plans from a sanitary standpoint, to supervise the hygiene of dwellings, factories, and sewers, and in short, anything that can influence the public health ; to take adequate measures against infectious diseases ; to provide gratuitous vaccination.

(*e*) To control the quality of drinking water and of foods.

The singular fact that every member of the medical staff has his assistant, is due to several causes, the chief being that every death and every birth must be verified at the abode by a medical man. (This is in accordance with the municipal order of the 1st October, 1880. It is vigorously maintained throughout Belgium. In districts destitute of doctors, this formality must be carried out only by a member of the local authority.) Another reason is that every town official has the right to a

month's leave of absence each year, and it has been found necessary, in order to ensure regular and uninterrupted discharge of municipal duties, in case of leave of absence or a vacancy, that there should be a substitute familiar with the duties of each post. The assistant-doctors are not however nominated simply to fill the vacant posts. The assistant of the chief inspector presides over vaccination, and directs the medical service in case of accidents; the assistant-divisional doctors are charged with the care of school hygiene.

Verification of Births and Deaths (*Instructions for the doctors appointed to verify births and deaths at the abode.*) The essential directions on this head are as follows:

No burial can take place before the death has been verified by the divisional doctor after a complete and careful examination of the body.

This verification, as well as the identification of the deceased, must be certified in accordance with a given scheme.

For those dying at birth, the certificate should state if death occurred before, during, or after the accouchement, and in the last case how long the infant lived after its birth.

In times of epidemic disease, and always when the nature of the case demands it or the family requires it, the doctor should inform the police, in order that the body may be immediately conveyed to a mortuary.

If the death has been caused by an infectious disease, the doctor should at once inform the chief medical inspector, and give, in accordance with his instructions, the necessary orders for preventing the spread of infection. At the same time the police should be informed, so that they may supervise the disinfection and see to the carrying out of all other orders.

When a divisional doctor has attended the deceased, his assistant must verify the decease, and the same in the case of births.

Every week-day from three to four o'clock, at the sanitary office, the doctors ascertain the births and deaths requiring verification; on Sundays and holidays from the porter at the town-hall. If there are no cases to be verified, an intimation is sent to them.

When a case is stated to be urgent, the verification is made immediately.

The birth of an infant ought to be notified within the three following days. The father is bound to make this notification, or in his absence the doctor, the midwife, or some other person present at the accouchement. If the mother is delivered away from home, the notification must be made by those with whom she is living.

The divisional doctors much report each day to their chief officer all the cases verified, as well as a weekly summary of the cases. The local administration supplies the necessary forms for these purposes.

Demographical and Medical Statistics.—The very exact verification of births and deaths has furnished material for very valuable statistics on the sanitary state of Brussels. They have been utilized with great

talent by Dr. Janssens, the head of the *Service d'Hygiène*, who has made them the foundation of all his measures. Such statistics form at present an integral part of the public health service, and are published regularly in all great towns. Brussels, in consequence of the amount, exactitude, and duration of its statistics (since 1860) occupies the first position among continental towns. The weekly report, published by the sanitary department on the demographical and medical state of Brussels, contains also similar particulars concerning most of the Belgian towns, and a great number of cities in other civilized countries, and has become an international organ of the sanitary state of all the countries in the world. The information contained in it cannot fail to provoke among nations a noble emulation to remove the conditions which engender disease, suffering, and premature death.

The medical topography of Brussels is also described, indicating the sickness and mortality in different quarters of the city. In addition to the weekly reports, the sanitary department publishes an annual report containing a summary of the fluctuations of population and statistical tables showing the causes of death.

Tables are also given stating the deaths according to localities and months of the year; others according to age, sex, and social position of the deceased; and the number of suicides, murders, assassinations and accidents are recorded.

Sanitary statistics now form everywhere the basis of public hygiene. By their means the feeble points and the result of improvements already effected can be indicated.

In Brussels, the death-rate per 1000 inhabitants has been as follows:—

From 1865 to 1869	31·96
From 1870 to 1874	28·50
From 1875 to 1879	27·34
From 1880 to 1884	25·22
From 1885 to 1888	21·92
1889	19·4
1890	21·5
1891	22·3

First Aid in Accidents.—Brussels possesses eight ambulance stations. In each of these is a bed ready for use, and arranged so that it can serve as a litter. It also contains a very light litter, made of a piece of canvas in a wooden frame, and a carriage on springs, for the litter, with a case for dressing wounds, which can be fixed on the axle of the carriage. In addition to these complete stations, there are four places where are placed a dressing-case and litter. Similar cases for dressing wounds are found in all the primary schools. The chief ambulance officer is the assistant of the medical inspector; police and firemen are on duty at each station. A copy of the *Manual of First Help in Case of Fire, etc.*, is given to each fireman.

Building Regulations (8th January, 1883).—Only the clauses affecting the public health are given here.

Necessity for permission to build, and rules regulating building.—No new building or reconstruction of an old building can be begun without the previous permission of the burgomaster and aldermen. The application should be accompanied by plans and sections of the proposed building; and the authorities have the right to make such alterations in them as they judge necessary in the interest of health. The plans ought to be made to the scale of 2 centimetres to a metre.

Permission is equally required to dig a well, to repair or abolish a cesspool, to construct a drain or branch drain.

No building may be covered over before being inspected. The painting as well as the form of the frontage must be officially approved.

The college of burgomasters and aldermen ought to be informed in writing the day on which it is proposed to commence the work.

Every site where building, rebuilding or demolition is going on, ought to be surrounded with a barrier of planks at least two mètres high, and doors should be made to open inwards. To ensure the workmen from accidents, painting and similar work must not be done by the aid of unfixed ladders, but by scaffolds or such other arrangement as has been authorised by the assembly of magistrates and aldermen. A workman must be stationed at the foot of each ladder. Pulleys, cords, and all materials and implements must be strong and in good condition. Ladders reaching beyond the first storey ought to be secured about the middle by means of cords with pulleys fixed to the frontage.

Pits, cesspools, soakage-wells and drains, before being filled up and abolished, should be thoroughly cleansed to the bottom and disinfected. The collège can insist, in addition, on the partial or total demolition of masonry, and the carrying away of the earth which has become impregnated with organic matter. During the carrying out of such work, the owners must submit to every precautionary measure ordered by the administration to prevent accident or injury to the public health. In repairing or doing away with drains, the mud coming from them ought to be immediately removed; it must not be deposited on the public road, except temporarily, and then some efficient disinfectant must be used.

The stones are conveyed to the workshop ready cut, so that they may be immediately used. No plastering or ornamental work is allowed on the premises unless an efficient hoarding is erected to prevent particles reaching the neighbouring houses or falling on the public way.

Rubbish and other *débris* must be removed each day.

The materials employed in the building are required to be of good quality.

The officials of the local authority are to have daily free access to the workshops. If they find anything wrong there, the work is suspended, and they report to the collège of burgomasters and aldermen, who give the necessary orders in the event of dispute.

The foundation walls ought to be built on a soil which is naturally good, or rendered so by artificial means. All necessary measures must be taken to ensure freedom from dampness.

Height of houses and rooms.—Court-yards, rain-water pipes, guttering, etc.—The height of house frontages in public streets is determined by the width of the street. The maximum height of frontages is—

(1) 21 metres (68·88 feet) on public places, boulevards, and streets of 15 metres (49·2 feet) wide and upwards.

(2)	20	metres in streets	14	metres	wide.
(3)	19	,, ,,	13	,,	,,
(4)	18	,, ,,	12	,,	,,
(5)	17	,, ,,	11	,,	,,
(6)	16	,, ,,	10	,,	,,
(7)	15	,, ,,	9	,,	,,
(8)	14	,, ,,	8	,,	,,
(9)	13	,, ,,	7	,,	,,
(10)	12	,, ,,	6	,,	,,
(11)	11	,, ,,	5	,,	,,
(12)	10	,, ,,	4	,,	,,
(13)	8	,, ,,	3	,,	,,

Note.—1 metre = 3·28 feet.

The height of frontages is taken at the middle of the buildings from the pavement to the cornices of the coping, so as to include attics.

The width of public roads is measured from the face of the frontage walls.

The height of ground floor rooms and attics used for habitation, ought to be respectively, at least, 2·8 and 2·6 metres; of intermediate rooms, 3 metres.

Attics, unless their windows reach at least 2 metres above the floor, ought to be furnished with ventilating arrangements approved of by the collège of burgomasters and aldermen.

Every house ought to be provided with a yard, the size of which is determined, according to circumstances, by the collège of magistrates and aldermen (who refer it to the Bureau d'Hygiène). Rain-water pipes should be of metal, sufficiently large, and running perpendicularly to the ground-level, where they discharge on to the pavement.

Any one wishing to establish near a party or other wall, a stable, salt store, or collection of corrosive materials, must leave at least 10 centimetres (3·9 inches) space between this wall and the proposed structure.

Wells, cisterns, pits, cesspools, soakage-wells.—(Art. 72.) Wells must be built of special bricks, called *well-bricks*; the masonry should rest on a ring of oak or beech at least ·08 metre thick, or on a ring of cast-iron at least ·025 metre thick.

(Art. 73.) The walls of wells, reservoirs, and any pits used for dung or liquid manure, should be independent of walls forming the foundation of buildings, and should be separated from these by an interval of at least one decimetre (3·94 inches).

(Art. 74.) Between a well or reservoir and a pit, a distance of at least 2 mètres should be allowed.

(Art. 75.) The foundation and the walls of every pit should have a thickness of at least ·28 mètre; they are covered within and without with an impervious layer of cement, or of tiles set in cement; all the angles ought to be rounded off.

(Art. 76.) Every pit ought to be covered with a vault, at least ·18 mètre thick, dressed with very hydraulic mortar.

(Art. 77.) The orifices of wells, reservoirs, and pits ought to be closed by solid lids of stone or iron. Sometimes wells dug in yards and gardens, or in uninhabited parts, may be left uncovered, but they ought in this case to be surrounded by a wall at least 1 mètre high, formed of bricks at least ·28 mètre thick, of granite at least ·1 mètre thick, or of iron railing. The covers over pits should fit tightly.

(Art. 78.) No cesspool or pit for foul water is allowed, which permits of soakage into the surrounding soil.

Water-closets and drains.—(Art. 79.) Every dwelling-house or assembly-room should be provided with a sufficient number of water-closets, having external ventilation by means of a door or window, and otherwise sanitarily arranged.

The building of closets for the use in common of several houses can be authorized by the collège, in cases where it appears impracticable to provide a separate closet for each house. The number of seats should be in all cases at least 1 for every 25 inhabitants.

(Art. 80.) Every dwelling-house or assembly-room should be provided with a system of conduits securing immediate discharge into the public sewers of foul water and of liquid and solid excreta.

Every newly-erected house should have a separate drain, and be separately connected with the main sewer.

(Art. 81.) The drains are constructed of stone-ware pipes, of bricks, or other materials sanctioned by the administration. They should be firmly fixed, so as to prevent all settling of pipes, or separation of joints, and should be perfectly water-tight.

(Art. 82.) The chief drain-pipes should have a minimum internal diameter of ·225 metre (about 9 inches). They are formed of stoneware of good quality, with a glazed internal surface. The different portions should have good sockets, without internal projections; the joints are set in cement and rendered perfectly water-tight.

Brick drains must be built with a very hydraulic mortar, and the internal surface covered with a complete and smooth layer of cement. They should be at least ·30 mètre wide, and ·36 mètre high.

(Art. 83.) Branch drains should be at least ·125 mètre (4·9 inches) in diameter, and be constructed in the same way as the chief drain.

(Art. 84.) At the point of junction of two drains, the top of the branch drain should not be lower than that of the main drain: the junction should be at an angle of at least 135°.

(Art. 85.) Changes in the direction of drains should be by means of curves or bends having an angle of at least 135°.

(Art. 86.) Inspection openings should be arranged at points where the possibility of deposits is feared, either within the premises or under the pavement. They must be so constructed as to be both air and water-tight.

(Art. 87.) The sanitary officers determine the position and level of the house-drain with the public sewer. Wherever practicable, the level is arranged so that the outlet of the private drains is free, entirely or in part, when the water in the public sewer is at its highest. Generally the junction ought to be made immediately below the origin of the arch of the public sewer, in every case at least ·30 mètre above the inverted arch of this sewer.

(Art. 88.) The fall of drains should be regular and sufficient. To this end, houses should be built at a sufficient height in relation to the level of sewers, or the drains should be raised on supports above the pavement of cellars. In the latter case the administration enforces the measures necessary to secure complete impermeability and to prevent soakage.

(Art. 89.) The pipes for slop water and fæcal matters, and for rain-water of courts and gardens should be at least ·10 mètre (about 4 inches) in diameter. They are of lead at least ·006 mètre thick, or of glazed stoneware, and should be constructed so as to be easily accessible for examination and repairs, and not imbedded in the walls. The junctions with the drains are made by means of pipes curved, or bent at an angle of at least 135°.

(Art. 90.) The overflow pipes from cisterns should discharge into the external air, and not be directly connected with the drains.

(Art. 91.) All waste-pipes for foul water, and soil-pipes should be trapped as near as possible to their origin.

(Art. 92.) Traps within the house should have a water-seal at least ·06 mètre deep, and of a shape approved by the collège. Traps placed in courts and gardens have a smaller water-seal than those in the interior of houses.

(Art. 93.) Where from local circumstances the outlet of a private drain into the public sewer, or of one public sewer into another, is likely to be occasionally under water, a ventilating-pipe should be placed at the upper end of the house-drain. This ventilating-pipe should be furnished with a feeble water-seal, and open above the roof of the house. A similar ventilating pipe should be fixed in all cases where there are two traps in the course of the same sewer, to be placed below the upper trap.

(Art. 94.) In every building, which is not sufficiently high in relation to the public sewers to prevent the flooding of cellars, the junction with the sewer should be provided with a flap or cock, or other apparatus, to prevent overflow from the sewers. At the same time, rain-water pipes should be so arranged, that in case of need they can discharge into the public sewer without passing through the house-drain

(Art. 95.) Every owner about to erect a new building, submits to the administration two plans, showing the drainage from the highest storey to the junction with the public sewer, with closets, cisterns, wells, pumps, water-taps, traps, and other details. After examination and modification, if necessary, one of the plans is returned to the owner, the other being retained by the administration.

The administration can require the production of these plans, before authorising any modification in existing buildings.

(Art. 96.) Under special circumstances, the assembly of burgomasters and aldermen can authorise or order modifications of the requirements under the present heading.

Dangerous buildings.—(Art. 98.) When a building or wall or other erection contiguous to the public way appears to be in danger of falling, the burgomaster inquires into its condition through one of the officers charged with the supervision of buildings, assisted by a police inspector. An official report of the state of the premises is sent by these officers to the burgomaster, who at once advises the owner of it.

(Art. 99.) If the danger is considered imminent, the burgomaster orders the owner without delay to demolish the dangerous erection.

In the event of refusal or delay to comply with this order, the burgomaster orders the demolition of the dangerous erection at the cost of the owner.

If the danger does not necessitate immediate action, the condition of the premises is reported to the owner, with the order to demolish, repair, or temporarily prop them up, within a prescribed time. Any owner not completing the required work within the period named is brought before the courts. If the owner is absent, the necessary work is done at his expense by the administration, under the order of the burgomaster.

Regulations respecting Highways (October 25th, 1865).—Every owner or occupier is required to sweep each day before 8 a.m. in summer, and before 9 a.m. in winter, the portion of the street before his house, garden, and enclosure, and to collect in a heap any dirt and filth found there. The sweeping should, when necessary, be preceded by sufficient watering to abate dust.

It is unlawful to throw or deposit on the public way any dirt, remains of food, pieces of pots, broken glass, or anything which would obstruct locomotion, or cause offensive effluvia.

It is equally unlawful to allow waste-water or offensive matters to flow from the interior of houses.

Farm labourers remove each morning the dirt and other offensive materials placed in front of their houses in buckets or baskets.

Urination is forbidden in public streets, except in urinals provided for this purpose.

The proprietors of cafés and publicans are obliged to provide urinals for the use of their customers, and to maintain them in a cleanly condition.

It is forbidden to throw anything into canals, rivers, ponds, or fountains, more especially household refuse, broken pots and glass, and dead or living animals.

It is forbidden to wash in canals, ponds, and fountains in the town, linen or anything else which would foul the water.

It is forbidden to throw stones or dirt on the ice on any pretext.

The collège of burgomasters and aldermen is authorized to forbid the occupation of houses or rooms whose filthiness or defects of ventilation or drainage render them permanently unfit for habitation.

Every order for closure of such premises should be preceded by a report of the local medical commission, and a month's notice given to the owner and occupier. Where the owner begins the necessary work for putting the premises into a sanitary condition immediately after receiving the above notice, an extension of time is granted sufficient to enable him to carry out the orders of the assembly.

Regulations as to the Sale of Meat (May 31st, 1878).—The slaughtering of cattle is allowed only in the abattoirs of the town. The meat is here submitted to an inspection in accordance with the regulation of 1877 and, is officially stamped. Failing special permission, the carriage of meat ought always to be effected during the day. Dead meat brought into the town, whether fresh or salt, must be examined and stamped in stations for this purpose. The charge for this inspection is three centimes par millogramme.

The owner of the meat presented for examination, should state his name, address, and the destination of the meat. This statement is entered on the certificate of inspection, along with the day and hour on which the latter is made.

The meat ought to be conveyed immediately to its destination.

During transport the stamp and certificate of the meat must be shown when demanded. Meat introduced into the town by private individuals for their own consumption is exempt from inspection, but if required they must give their name and address.

It is not permitted to transport any meat from towns other than those named.

The introduction of prepared offal is permitted on the same conditions as that of meat. Offal not prepared, as also fresh meat, can only be dressed at the abattoir.

All meat found to be unsound, or of bad quality, should be seized and destroyed, in accordance with the regulations for abattoirs (page 224).

Sanitary Provisions as to the Air.—As might be expected in an ancient city like Brussels, narrow and tortuous streets are found, bounded by high houses, which impede the access of air. They are disappearing little by little; the bureau d'hygiène and its zealous chief, Dr. Janssens, do not fail to impress upon the burgomaster that it is necessary to ameliorate this state of things.

The old quarters inhabited by the working class have been replaced by

elegant boulevards, which stretch without interruption around the town. Another boulevard extends across the centre of the town from south-west to north-east, and a large number of wide and new streets run in different directions.

These boulevards are planted in their whole length with a double row of trees, in some parts the trees being in rows of three and four.

Brussels is not rich in open places : but has a few of great beauty. We may mention first the Place de l'Hôtel de Ville, on one side of which is the palace, on the other the house of the ancient corporations of traders, buildings which rival each other in the ancient character and elegance of their architecture ; the Place du Sablon, adorned by a touching group representing the martyrs Egmont and Horn ; the Place du Congrès, where is erected the column in commemoration of the Revolution of 1830.

Brussels possesses many beautiful parks, some within the limits of the town, others beyond its limits. Nevertheless they secure fresh and pure air for the inhabitants ; and nature and art concur to make them as attractive as possible. These parks are,—the botanical gardens, near the northern boulevard of the town ; the royal park, near the palace ; and the wood of Cambre, and the forest of Soignes, at a short distance from the town, which form most imposing wooded parks.

The Belgians are far from equalling the English in their sense of the sanitary importance of pure air. They have great fear of draughts in their houses. Arrangements for admitting fresh air into a room are generally wanting. Chinks of windows and doors are closed to prevent catching cold. Hospitals and public establishments are usually ventilated only by windows and chimneys. Artificial lighting is chiefly by coal-gas, but the burners do not serve at the same time for ventilation.

In newly-erected schools there has, however, been introduced a better ventilation by means of a central heating apparatus, provided with arrangements for introducing fresh air. This system, like others, appears too complicated to be undertaken by persons without technical knowledge, and it is only applicable during the winter season.

The leading Belgian classes are in accord as to the utility of ventilation ; but this intelligent view has not yet spread among the people, who do not use the most simple appliances.

Sanitary Provisions as to Water.—Thanks to the geological character of the soil of Brussels and its environs, it receives an abundant supply of pure water. In olden times the town was noted for the richness of its sources of water (*copia fontium*). The water forms springs on the most elevated slopes of the town, a fact which led to the construction of public fountains in the 13th and 14th century, some of these still remaining.

Research has shown that the country has three water-bearing strata. The highest stratum is at a depth varying from 2 to 20 mètres ; in the second 50 mètres (164 feet) ; the third 10 mètres still lower. This subterranean water is of good quality, and does not require artificial filtration. It

is clear, fresh, and inodorous, its temperature being from 10° to 12° Cent. (50° to 53·6° Fahr.).

Works bearing on public health in Brussels date from 1830. Shortly afterwards, the need of a public provision of water was seen, the numerous wells,—of which there was one in nearly every court,—being suspected to be a cause of the frequent grave epidemics which arose. But for economical reasons, this did not become an accomplished fact until 1852, although since 1601 there had been a localized distribution of water in the rich quarter around the royal park.

There are three systems of water supply. In the first, the *old drinking waters*, the water of the upper stratum situated at a higher level than Brussels, is conducted directly to a reservoir near the Colonne du Congrès, and is distributed to the lower quarters of the town, supplying 1000 cubic metres (2,200 gallons) per diem.

In the second system, the *water of the Hain*, the water is intercepted at the sources of this river, 22 kilometres (13·68 miles) to the south, and 120 metres above the level of the town. It is collected in small reservoirs, placed several inches below the level of the soil. Canals of masonry convey the water thence to a *general conduit*, also of masonry, which gradually increases in size until it becomes the *great aqueduct*, having a sectional diameter of 1·70 mètres, and thickness of 1·10 mètres, and a fall of one-fifth of a millimètre to each mètre. This ends in a reservoir in masonry 20,000 cubic mètres in contents, the floor of which is 87·5 mètres deep, and the overflow 2·5 mètres higher.

Another conduit, belonging to the *water of the Hain*, brings water from the lower districts, necessitating the use of pumps for raising the water. A reservoir 12 mètres deep is provided for this water, into which the water is brought from three groups of sources by three canals. From this reservoir the water is pumped, and brought into the great aqueduct.

In course of time this system was found defective in several respects; the small reservoirs and their supply canals were, from their vicinity to the surface of the soil, often contaminated; the water was not of uniformly good quality; and the pipes were often choked. In addition the supply of water diminished in the higher points of origin, the water forming new springs at a lower level. This arose chiefly from the fact that the network of canals had too great a fall, and was placed too near the surface of the soil. Where possible, the collecting canals were placed more deeply, and nearly horizontal, and made of porous drain-pipes. The water collected in these pipes is straightway conveyed to the conduits by means of cast-iron pipes. By these alterations the amount of water supplied by the system of the Hain has been raised from 19,000 to 29,000 cubic mètres per diem.

In consequence of the increase of population, it was necessary for the distribution of water to construct a third reservoir, the Château d'Eau, situated near the Leopold Park. The water is pumped into this by two machines of 50 horse-power.

The conduits in the town consist of cast-iron pipes varying in diameter from 6 to 60 centimètres, provided with sluices, openings, and outlets at the highest and lowest points. They are provided at average distances of 60 mètres with fire-plugs.

The quantity of water from the preceding systems became in time insufficient, and a third system of water supply had to be established, called *the water of the wood and forest.*

We have mentioned in a preceding paragraph the great parks, the wood of the Cambre, and the forest of Soignes, situated to the north of the town ; and it is from their drainage that the water of this system has been procured, amounting to 8,300 cubic mètres per diem. There is still such a large proportion of these parks undrained, that probably 18,000 cubic metres could be obtained daily from them. The water from this source is brought to the place Jourdan, into a reservoir having a contents of 20,000 cubic mètres ; its sectional diameter being 53 mètres, and the overflow 5 mètres higher.

The mean daily consumption of water is distributed as follows :—

Special agreements	9,530 cubic mètres.
Public services	7,500 „ „
Waste and loss	7,960 „ „
Total	25,000

The cost of establishment has risen to 11,734,357 francs.

The annual cost is distributed as follows :—

5 per cent. interest on capital	568,700 frs.
Salaries	133,000 „
Working and maintenance	105,000 „
Total	824,700 „

Thus a cubic mètre (2·2 gallons) of water ready to be delivered to the consumer costs 6·1 centimes, if reckoned in proportion to the quantity which can be delivered from the aqueduct, *i.e.* 37,000 cubic mètres per diem. In proportion to the mean daily consumption (25,000 cubic mètres) the cost is 9·4 centimes ; and if worked out in proportion to the amount actually supplied for private persons (9·53 cubic mètres), the cost is 22·3 centimes per cubic mètre of water.

Control of Foods.—There is a chemical laboratory near the Sanitary Office. The average annual number of analyses of food is 1,500, of which about 700 are foods, 350 water, and 450 other substances.

In the last 14 years, 8,226 analyses of food have been made, and 605 have been found to be adulterated. The greater part of the adulterations were of milk ; out of 539 samples, 224 were adulterated ; out of 276 of butter, 81 adulterated ; out of 178 of wines, 25 adulterated. Coffee (220

analyses), and tea (242 analyses), in all the analyses have been found to be pure, but this did not hold good for chocolate and chicory.

The supervision of foods at Brussels rests chiefly with the municipal police, who act also as a sanitary police. For this reason the Sanitary Department has only one officer for these duties.

The police has a special staff for supervision of foods, comprising :—

A chief inspector ; four expert inspectors ;
An expert inspector for poultry and game ;
Four expert inspectors for fish ;
Two expert inspectors for butter.

The examination of foods is preventive in character, as we have seen by the regulations on page 237.

In Belgium, as in England, the trichina is not specially searched for in pork, and as pork is always eaten cooked, no cases of trichinosis have been observed.

Public Markets.—At Brussels there are two great markets for food-products. In one, the *covered market* (or *Marché de la Madelaine*), are sold vegetables, fruits, and poultry. The entrances are in rue Duquesnoy, and rue Saint-Jean, and the market has two storeys on account of the different levels of these two streets.

The other market, a larger one, is the *Halles Centrales*. It is built of iron and glass, with departments for meat, poultry, vegetables, and fish. The floor is paved ; there are water-taps for washing, but its cleanliness is not equal to that of the London Meat Market.

The sale of meat is free and unrestricted ; but each stall or shop and its arrangement should be approved by the Sanitary Authorities before commencing the sale.

The interior of these shops is arranged as follows : the floor is of asphalte or cement ; the walls are of marble, glass, slate, or plastered, and painted in oil ; the ceiling is plastered, and painted in oil. On the floor sawdust is scattered and renewed each day. The meat is suspended on hooks. The partition separating the stall from the street is raised during the day, so as to leave the stall completely open, and the best meat is there exposed.

The table is of marble or other stone. In each stall there is a supply of water, and arrangements for carrying of waste water, thus making complete cleanliness possible.

Milk is sold in shops, or conveyed in carts drawn by dogs. The receptacles for milk are of tin-plate. There are two kinds of shops for milk : *dairies* and *cow-houses*. In the first, the milk comes from the country ; in the second, from cows on the same premises. The authority of the Bureau d'Hygiène is required for keeping cows in the town, and sanitary regulations must be carried out in such cases. The same applies when any one wishes to open a dairy. In both cases the milk may be drunk on the premises, or carried home.

Scavenging Arrangements.—Although the police regulation of 1865 imposes on the inhabitants the cleansing of the street in front of their houses, this regulation has fallen into desuetude, and municipal arrangements for scavenging are made.

Since 1881 the Scavenging Department is supervised by a special committee, composed of the alderman of public works, the president, and four members chosen from its number by the Municipal Council.

In addition to supervision, this committee submits to the assembly of burgomasters and aldermen all the improvements which they consider necessary. The members of the committee in turn take monthly charge of the general supervision.

The annual report on the work of the committee is presented at the same time as the plan of budget.

The scavenging staff is composed of :—

A director ;
A chief clerk ;
Two heads of depôts ;
Three employés ;
A veterinarian ;
Three inspectors ;
A storekeeper ;
Fourteen overseers
400 to 500 workmen.

In this number are included, in addition to those engaged in scavenging proper, wheelwrights, smiths, saddlers, mechanics, unloaders, etc.

The working material consists chiefly of :—

100 horses ;
21 sweeping machines, drawn by horses ;
81 carts for refuse ;
75 watering carts ;
17 prams for carrying offensive matters.

The streets are swept by hand or by means of sweeping machines. They are watered before being swept to avoid dust.

The staff is divided into gangs, a complete gang comprising :—

Two watering-casks ;
Four carts for refuse ;
Ten horses ;
Ten carters ;
One overseer.

The watering, which is carefully done in Brussels, forms part of the scavenging arrangements. It is done chiefly on foot, but watering-carts are also employed. Narrow passages and certain streets are so abundantly watered that they are always perfectly clean.

The refuse from courts is removed at 7 a.m. from the 1st October to the end of February ; at 6.30 a.m. in March to September ; and at 6 a.m. from 1st April to 31st August.

The public urinals, numbering about 200, are regularly cleansed each day.

All refuse is conveyed in carts each day to the ash-yard on the landing-stage of the *Willebroeck* canal, whence they are conveyed in boats directly to farmers, or to the depôt at Evère beyond the town, on the margin of the Willebroeck canal.

Domestic waste water and water from water-closets is conveyed directly to the sewers.

Stable manure is placed in pits paved in brick (see p. 233), which ought to be approved by the Bureau d'Hygiène.

Swine are permitted to be kept in the town, but only in small number in one place. The construction of pig-styes is regulated by the Bureau d'Hygiène, and their cleanliness is supervised by the police.

The Brussels Abattoir.—The public abattoir and the cattle market are situated near the boulevards, in a part called the *boulevard de l'Abattoir*.

The abattoir is composed of two lines of buildings, divided into compartments as in England. Near each compartment for cattle is a place for the keeping of meat and of hides. The animals to be slaughtered are brought in singly ; or if several at a time, they are tied to the external wall. The smaller animals are kept in a lair near the slaughtering-room. Cattle and the smaller animals are ordinarily slaughtered in different places.

The slaughtering-room is about 50 mètres square, with two large entrances opposite each other. The floor is paved and sloped towards the centre, where is an opening for drainage. The walls are of brick, cemented on the inner side.

To the right of and at right angles to the abattoirs is a long building, which contains rooms for scalding pigs, melting fat, and dressing tripes.

On the opposite side, and separated from the abattoirs by a large yard, are two rows of lairs for the animals. In the yard is the inspector's house, and near the entrance is another building, containing the offices and dwellings of employés.

The yard is paved, supplied with water, and well drained.

The animals are killed by a blow on the head from a pole-axe, followed by opening the jugular veins. The blood is collected in flat galvanized iron vessels, and then emptied into casks outside the abattoir. It is then conveyed to an establishment in which albumen and guano are manufactured from it.

This manufactory belongs to a private company, which has acquired the right to all the blood from the abattoir for a term of years.

The intestines are collected and placed in the yard near the rooms for dressing tripe. Here they are opened, and the contents cast on the ground. The paunches are then treated in these rooms and prepared as tripe. The contents are removed by the scavenging department and conveyed to the boats on the canal of Willebroeck.

The abattoir is municipal property. The following are the chief regulations respecting it :—

General Arrangements.—It is forbidden to kill and dress animals for food, to melt coarse fat, to prepare and to cook offal, except in the public abattoir.

Tripe dressers and fat boilers are entitled to fix in their rooms stoves, furnaces, cooking and other necessary apparatus for the preparation of tripe and the melting of fat, but their plans must be previously submitted to the approbation of the burgomasters and aldermen. They are responsible for all damage done in the rooms occupied by them. They must annually scrape, wash, and whitewash the interior walls of the rooms and of the scalding-tubs, and keep the places and their approaches in a cleanly condition.

Staff.—The staff of the abattoir consists of a chief inspector, who is always a veterinary surgeon; expert inspectors chosen from among veterinary surgeons or butchers of old standing; a collector, a chief of the service, and customs officers. It is the duty of the chief and expert inspectors to inspect all animals entering the abattoir, and to examine meat before it leaves. The chief inspector makes a report of cases of disease found by him, and generally of all facts relating to the public health and the abattoir.

In the event of dispute as to the condition of any meat, two expert arbitrators are called in, these being appointed annually by the assembly of burgomasters and aldermen. Before commencing duty the inspector and the expert arbitrators swear to carry out their duties faithfully and well.

Inspection.—Animals intended for slaughter are previously visited by the expert inspectors. Those which are recognised or even suspected of being affected by a contagious malady, or from any cause unfit for food are placed in a pound, to be dealt with in accordance with the laws and regulations in force.

After slaughtering, the internal parts are examined; if necessary, the inspectors can cut the meat to ascertain its real condition.

The soundness of the meat is vouched for by an official stamp.

Meat and viscera suspected of being injurious to health are provisionally seized and locked up. An official report is made of the seizure, and as to the amount and condition of the meat seized, and the report is immediately taken to the chief commissioner of police. All meat seized is buried, if no objection is raised, within 24 hours. In contested cases an inspector and the expert arbitrators visit and examine the meat, and their decision is final. The cost of this examination is borne by the owner of the condemned meat.

Any one discovering in the course of slaughtering an animal signs of disease ought at once to inform an inspector. Similarly if a fœtus is found, the inspector orders it to be buried or otherwise disposed of not for food. This disposal is made in presence of a customs officer, according to the method prescribed by the municipal administration.

Slaughtering.—This can be carried on at any hour of day or night. Those wishing to kill at night ought to inform the chief inspector during

the previous day. The blood from slaughtering is received in buckets, emptied into water-tight barrels, and put on carts. These barrels can remain during slaughtering at the entrance to the slaughter-house, but must immediately afterwards be placed where directed by the chief inspector. They are removed from the abattoir on alternate days in summer, and once a week in winter.

Butchers are required to wash the slaughter-houses and their approaches with abundant water, and to keep the utensils which they use in a cleanly condition.

All offal is removed to the triperies without delay after having been inspected.

All filth is removed as soon as the work is finished and conveyed to the part allotted for this purpose by the chief inspector.

Triperies.—Utensils of lead, copper, or zinc are forbidden. They ought to be wrought-iron or tin. It is forbidden to allow dirty water to escape outside, or to deposit the remains of tripes, etc., in the yard.

Fat-melting places.—Plans of arrangements for melting fat should be approved by the municipal administration. It is forbidden without the special permission of the collège of aldermen to mix with the melting fat any foreign matter other than sulphuric acid.

Special police measures.—No one can be admitted to the abattoir without permission of the chief inspector. Sleeping in the slaughter-house market, or other place connected with the abattoir, is forbidden. Butchers and workmen are forbidden to leave the premises with their clothes stained with blood. Butchers' carts must be covered and have on them the number of the owner's slaughter-house.

The torturing of animals is expressly forbidden.

Cattle Market.—The cattle market belongs to the abattoir, but is separated from it by a street. It comprises two great market-places, covered and separated by a cross street. The ground is paved. The interior is divided by partitions for keeping the animals.

Special market days are fixed for different animals.

With the exception of milch-cows kept in the town, cattle are only allowed to pass through certain streets. No herd must comprise more than 15 oxen, cows or heifers. A herd of more than 8 horned beasts ought to have two drivers over 18 years of age.

The following regulations are in force:—

It is forbidden to expose in the market diseased animals.

Horned beasts must be separately tied. The men whose duty it is to place the cattle in the market and to drive them to the abattoir are appointed by the collège of aldermen, and furnished with a numbered plate.

The market for hides is held once a week in a prescribed place, covered by a roof, and paved. The market for fat is held twice a week, and fat may be brought into it from without. All spoiled fat is seized and destroyed. The fat is deposited at the abattoir on the days when there is no market.

Water-Closets, etc.—As stated in the paragraph relating to buildings (p. 234), water-closets are obligatory in Brussels. There are only a few of the privies formerly in use still remaining.

Brussels furnishes a very instructive example of change of opinion as to water-closets.

In many parts of the Continent, owing to the prevalent ignorance of the changes undergone by fæcal matter mixed with water, there is still opposition to the introduction of water-closets, which undoubtedly form the best system of closets. This was also the case in Brussels. In fact, in 1857 a regulation was made forbidding the establishment of water-closets without the special authority of the Municipal Authority, who would impose the necessary conditions.

In 1865 the collège of aldermen made a regulation which permits water-closets only in the houses of narrow streets and alleys. Since 1883 this is the only system permitted.

The Brussels water-closets are constructed on an English model. An ordinary form is that shown in Figure 74.

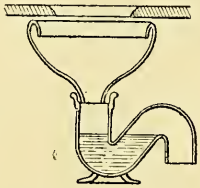


FIG. 74.—BELGIAN WATER-CLOSET.

Drainage of Houses.—The branches of house-drains are mostly of bricks and masonry, and ovoid in shape, from ·30 to ·36 mètre in diameter. Others are of glazed earthenware, with a diameter of ·25 mètres.

The traps of kitchens, laundries, courts, etc., usually resemble what is known in England as a dipstone trap (Fig. 75).

The dipstone is immerged to the extent of 2 to 6 centimètres, thus preventing sewer-gases from entering the house. Fig. 76 shows new forms of traps used for water-closets and waste-pipes from kitchen, etc.

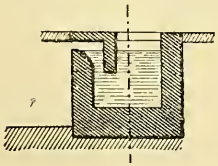


FIG. 75.—KITCHEN TRAP.

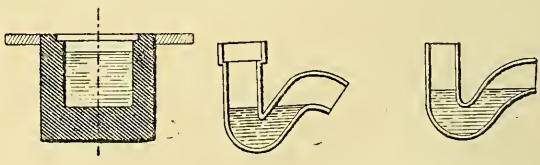


FIG. 76.—WATER-CLOSET TRAP.
(*Scale of* 4 *centimètres to a mètre.*)

Public Sewers.—The sewerage of a town is one of the chief conditions of its salubrity, and has been found to be one of the most delicate and difficult problems for sanitary engineers.

At page 134 the general principles on which sewers are now constructed

have been indicated. The system adopted in Brussels presents some interesting peculiarities, and differs considerably from that of England.

The sewerage of Brussels was begun in 1847, the first sewers being only intended to receive the waste water from houses. Unfortunately no general system was adopted; the sewers were constructed without any plan; sewers having a steep inclination were connected with others nearly horizontal; the arrangement of a street determining exclusively the form and position of a new public sewer.

Bad effects soon showed themselves; deposits were formed in the sewers, and infective gases of decomposition were evolved.

After a heavy fall of rain the chief sewers could not discharge all their water; the lower parts were flooded, and foul gases and water entered the houses from the sewers. The subsequent cleansing necessitated much trouble and expense without giving satisfactory results.

A Commission was appointed to prepare a complete scheme of a new system of sewers. All the sewers constructed since 1875 are part of this new system, and the greater part of the old sewers have been reconstructed.

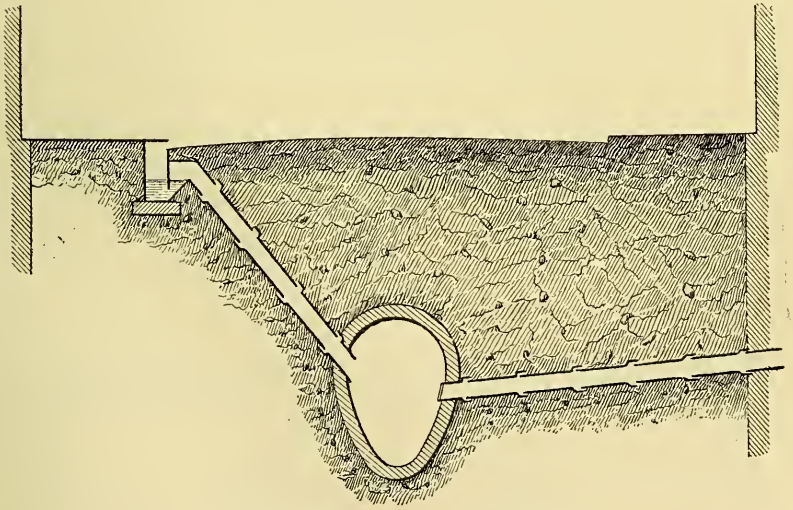


FIG. 77.—SEWER OF THE NEW SYSTEM.
(*Scale* 1 *centimètre to a mètre.*)

In adopting the new system, the following points have been kept in view: to prevent stagnation at any point, or the formation of deposits; to facilitate the flow of mud, the entrance of which cannot always be avoided, and to provide for free circulation of air.

To obtain these results the sewers do not as formerly run in a straight line from below upwards to the highest part of the town, but follow a broken line continued along the streets parallel to the lowest part of the town. In the steepest streets the sewers have a less fall, and in those

which are nearly horizontal a greater fall than that of the streets. In this way the best distribution possible has been made of the available inclinations, and deposits have been avoided by the uniformity of the currents.

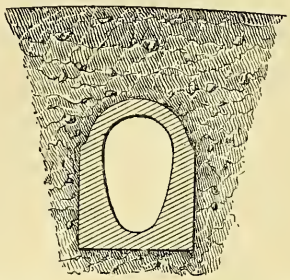


FIG. 78.—SEWER OF THE OLD SYSTEM BEFORE 1875.
Scale 1 *centimètre to a mètre.*

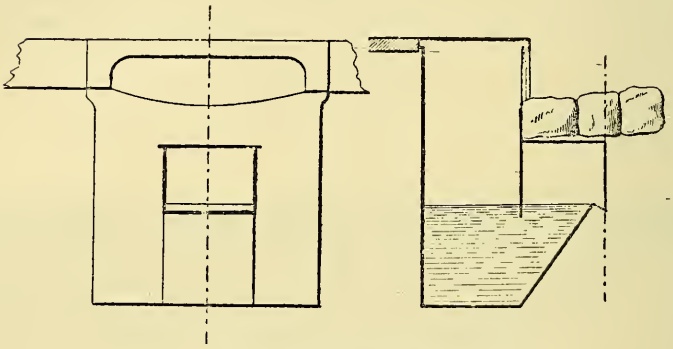


FIG. 79.—GULLY-TANK FOR RETAINING MUD.
(*Scale* 1 *centimètre to a mètre.*)

All the sewers of the new system have an ovoid form and a height of 2 mètres. The masonry is of bricks ·18 centimètre thick, rendered smooth within by cement. The sewers are generally placed 4 mètres below the surface.

Fig. 78 shows one of the great sewers before 1875. In the old sewers catch-pits were placed at intervals; but since 1852 this system has been abandoned.

The openings at the side of the pavement, for the drainage of rain-water, are furnished with a trap having a water-seal from 2 to 5 centimètres deep, and a tank for the retention of sand and other solid matters (Fig. 79). In certain parts these openings have gratings to arrest leaves, blades of grass, straw, etc.

Ventilating grids are placed over the sewer, so as to prevent any sewer-gases being forced into houses in the event of excessive rain.

Collecting and Discharging Sewers.—The sewers open into two great collecting-sewers, which run along each bank of the Seune to the

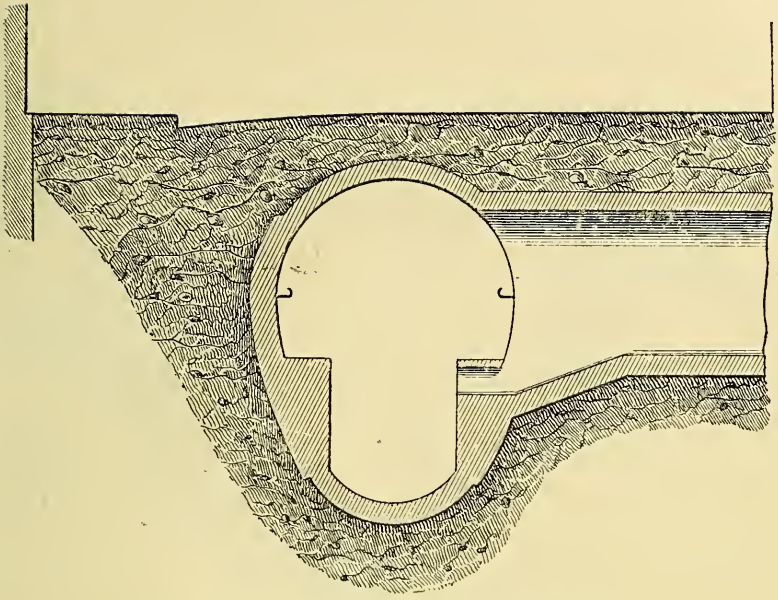


FIG. 80.—COLLECTING-SEWER FROM THE RIGHT.

outskirts of the town, where they again join together under the crossways of the *Avenue de la Reine* and the *rue Masui.* The collecting sewer from the left bank passes, near the bridge of Masui, under the river to reach the other bank. The two collecting-sewers combined are called the great collecting or discharging sewer. This runs parallel to the railroad to

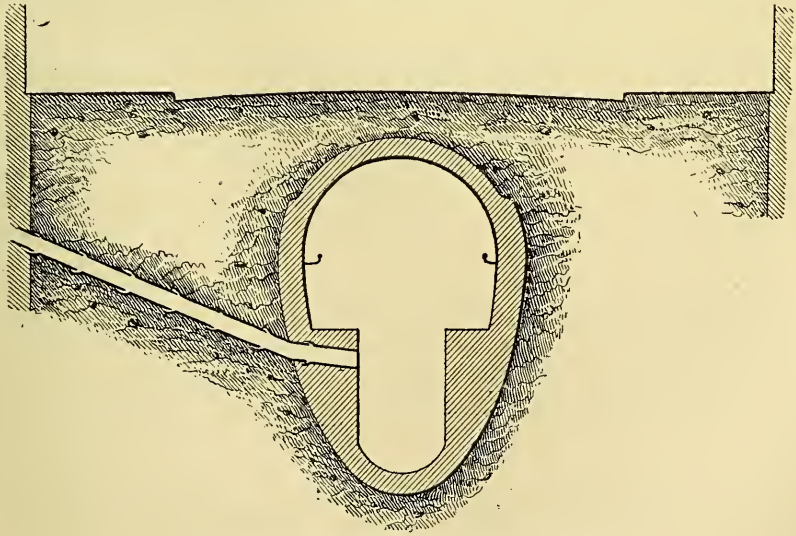


FIG. 81.—COLLECTING SEWER FROM THE LEFT.

Haeran, to the north of Brussels (a distance of 5 kilomètres); here it is discharged into the Seune.

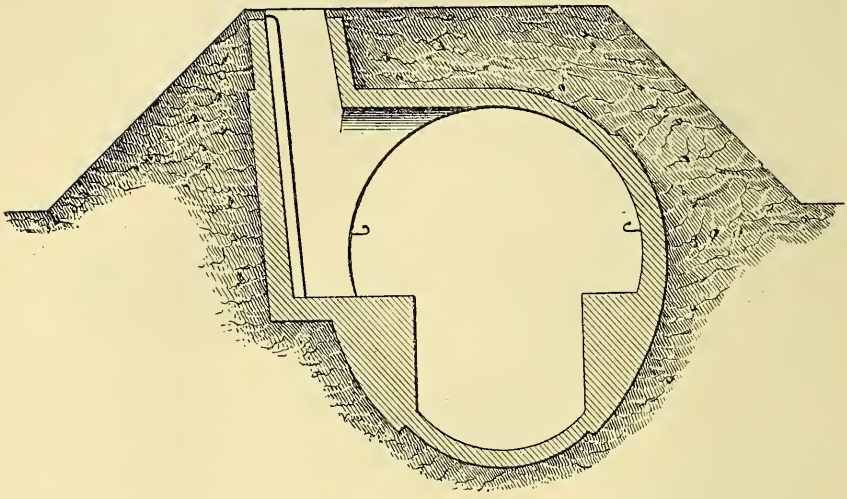


Fig. 82.—Discharging Sewer.

The two collecting-sewers are in the form of a cuvette, bounded by a footpath on each side, and covered throughout their length by an arch of sufficient height to allow one to walk freely.

The right collecting sewer (Fig. 80) is 1·70 mètres wide; the left (Fig. 81) 1·20 mètres. The discharging-sewer (Fig. 82) is of the same form as the two collecting-sewers, but its diameter is 2·20 mètres.

Until 1867 all the sewers of Brussels opened into the Seune, whose banks were covered with the houses of the indigent classes. During the dry season this river was practically a vast uncovered sewer, with borders of fœtid deposits. When heavy rains occurred the water, rising from the river, reached into the sewers opening below its level, forced the sewer-gases into the interior of houses, prevented the escape of sewage, flooded the subsoil, and on retreating left an enormous deposit of mud in the sewers.

When the new system of sewers was introduced measures were taken to remedy the nuisances arising from the Seune. The houses on its banks were demolished; boulevards, squares, and wide streets replaced the narrow and tortuous alleys. The bed of the river was made deeper and straighter in the whole of its course through the town. At the same time the sewers were detached, so as to protect them against variations in the level of the river.

Its bed is arched for a length of 2,150 mètres. The river is kept between two arches separated by a wall. The collecting sewers run on each side.

The footpaths along the sewers are furnished with iron railings, and on these wagons of peculiar construction run, which are used for cleansing. Rings of iron, placed at intervals of 28 mètres, serve to fix these. Hand-rails of galvanized iron are fixed in the wall about ·9 mètre above the foot-path. At intervals of 50 mètres there is alternately on the two footpaths an opening, reached by an iron ladder.

The collecting sewers running parallel to the river are connected with the latter by openings furnished with valves at their junction with the river.

These openings are placed on a level with the footpaths of the sewer, and are intended to act as overflows during excessive rain. Other open-ings connecting the collecting sewers and the Seune serve to admit water for flushing purposes. These openings are furnished with flaps.

The collecting sewers have generally a fall of 30 centimètres to a kilo-mètre ; at a few places the fall is increased to 50 centimètres. The fall being very small, it is necessary to remove the deposits which occur.

This is effected by sluices of a peculiar construction, called *wagon-sluices* (Fig. 83). They are of iron, and consist of a sluice fitted to the curve of

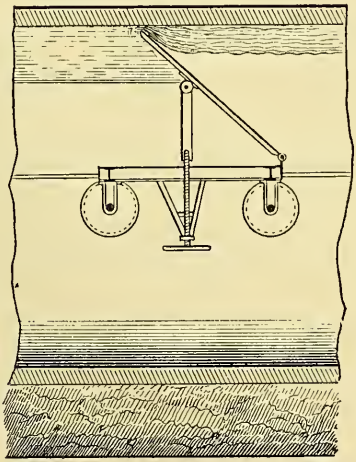


Fig. 83.—Wagon-sluice.

the sewer and connected by hinges to a wagon placed on four wheels and running on the rails of the footpath. By a single turn of the hand the sluice can be lowered or raised according to need.

When it is considerably lowered, the water is arrested above, and pass-ing with rapidity under the sluice, carries away all deposits.

Nine wagons of this description are in use for the cleansing of the col-lecting-sewers.

The deposits being continually removed, cannot decompose and pro-duce fœtid gases, and the air of the sewer is kept comparatively pure.

Since 1872 the question of utilising the sewage for surface-irrigation at

Loo and Pentley, near Vilvoorde, where there is suitable land of about 4,000 hectares (9,885 acres), has been discussed. The cost of this enterprise is so great that it has not yet been resolved to put it into execution.

For some time past a small part of the sewage has been employed in irrigating about 39 hectares of land near Machelen.

The discharging sewer empties into the river at Haeren, 50 centimètres under the water, which consequently rises on to the footpaths at this point, and cleansing of the sewer is impracticable. To obviate this difficulty hydraulic machines have been established at the outfall, which lower the water at certain intervals sufficiently to enable the wagon-sluices to do their work. This should be done once each week.

The hydraulic machines consist of three centrifugal pumps, 1·8 mètre in diameter, each worked by a 100-horse steam-engine.

The cleansing of the collecting-sewers employs 20 men, including those working the pumps. An equal number of men are employed in cleansing the street sewers.

The total length of the collecting-sewers is 18 kilomètres.

The expense of this great sewerage system has been 27 million francs, which includes the cost of the expropriation of 1,100 old houses on the banks of the river, and of other lands.

The embankment of the Seune and the collecting-sewers have cost 3,500 francs per metre. The cost is increased by 350 to 400 francs for the parts of the collecting sewers which do not follow the course of the river.

The street sewers, 2 mètres high, have cost 50 francs per mètre, including all the accessory works.

The work, begun in 1867, was completed in 1874.

Measures against Infectious Diseases.—Vaccination. — Vaccination is not compulsory in Belgium, although its utility is officially recognised, and the government does what it can to secure the voluntary vaccination of the population.

An animal vaccine institution has been established at Brussels, at the expense of the State, in order to secure a supply of good lymph. It adjoins the veterinary school, and there is one director for both institutions; there being over him a committee of four members nominated by the Minister of the Interior. This meets at monthly intervals at the vaccinating station, to overhaul the work, accounts, etc.

At each meeting the director ought to present a report on the work of the institution, and the committee has each year to render an account to the Government.

In inoculating a calf, or extracting its lymph, the animal is fixed to a special table. The skin of the abdominal region is shaved, and the parts washed with a 2 per cent of carbolic acid, and then carefully dried. Eighty incisions are then made 2 to 3 centimètres long, and the same distance apart from each other. The vesicles mature in 5 or 6 days; if they do not all develop simultaneously, the lymph is collected on two consecutive days. To gather the lymph, the vesicle is fixed by a special forceps, and

then the external crust is detached and not used. The pulpy mass and the lymph are scraped out with a lancet, received in a porcelain mortar, mixed with a little sugar of milk (lactose) and a third part of glycerine. The mixture is then pressed by means of an ivory spatula, through a fine brass sieve into a mortar of agate in which it is again well pounded.

The lymph thus prepared is placed in small glass tubes from 2 to 3 centimetres long, and furnished with a stopper, or between two layers of glass, of which one has a small central cavity. The tubes or glasses are then enveloped in cotton wool, and the lymph, which is required to be kept for some time, is placed in an ice-house. It is never delivered until the calves have been killed and found to be healthy.

Infants are not vaccinated in the same establishment.

The origin of the establishment dates back to 1883.

In virtue of the old laws of 1789 and 1790, which order municipal authorities to take the necessary measures against epidemics, many districts have organized a system of vaccination in a praiseworthy manner, and Brussels undoubtedly deserves to be placed in the first rank.

Vaccination is under the control of the Bureau d'Hygiène, and is carried out near the Sanitary Offices every week-day. It is quite gratuitous, as is also re-vaccination.

As soon as small-pox breaks out, the authorities distribute in the infected quarters some thousands of circulars, in which the preventive effect of vaccination, and the place where this can be secured, are explained.

Vaccination may be said to be almost compulsory, inasmuch as every child, in order to secure admission into the public schools, must produce a certificate of vaccination. In addition, all persons receiving relief, and their children, are required to be vaccinated.

School children ought to be re-vaccinated at the age of ten years.

Persons attending evening schools (professional schools) ought also to furnish a certificate of recent re-vaccination. The same obligation is imposed on those asking for municipal employment. In addition the clergy have been requested to secure that children having their first communion should be vaccinated or re-vaccinated.

Notification of Cases of Infectious Disease.—Isolation and Care of the Sick.—In accordance with a royal decree of the 31st March, 1818, all doctors in Belgium are required to bring to the knowledge of the burgomaster or of the Bureau d'Hygiène all cases of infectious disease which appear in their districts. A similar instruction, but with more rigorous regulations, was issued by the Municipal Authority of Brussels on the 18th November, 1824. Asylums, prisons, hotels, lodging-houses, inns, etc., are subject to the same regulation.

The diseases to be notified are : small-pox, scarlet fever, measles, typhoid fever, typhus, cholera, diphtheria and dysentery.

As soon as a case has been notified to the Bureau d'Hygiène, the medical health officer proceeds to make an inquiry into the sanitary state of the patient's home, and the probable origin of the disease ; and in-

quires as to any previous cases, whether the persons affected have been vaccinated, and as to whether there are any children in the house attending school, etc.

If the doctor in attendance on the case has stated these points in his certificate, then the health officer's inquiry is not deemed necessary. As soon as the health officer is in receipt of the above information, he makes his official report, and the necessary works are ordered to be executed.

The notification of infectious cases is made on certificate forms supplied by the Bureau d'Hygiène to each doctor.

By an agreement made the 26th December, 1874, between the authorities of Brussels and its suburbs, information as to the cases notified is interchanged weekly. Thus each is informed without delay of any cases of infectious illness outside its borders.

Brussels does not yet possess isolation hospitals for infectious diseases. They are treated in the two great general hospitals of St. Peter and St. John. The first is devoted chiefly to the treatment of typhoid fever, the second to the treatment of other diseases. Patients with typhoid fever are not isolated; those with infectious diseases are isolated as much as practicable. For small-pox there is a special isolated part on the highest storey of one pavilion of St. John's Hospital.

The importance of isolation is, however, fully recognised, and it is the duty of the medical health officers to secure the removal of patients to the hospital when isolation at home is impracticable.

By a resolution of the Municipal Council of 1880, patients suffering from infectious disease are forbidden to be conveyed in a public conveyance. For this purpose there is at the Bureau d'Hygiène a special carriage, which is placed at the disposal of the public on making application to the police.

The carriage is disinfected after each journey. The driver of any public conveyance is forbidden to convey any sick person who is not furnished with a medical certificate stating that he is not suffering from an infectious disease.

School children, whether sick or not, who live in a house where there is an infectious case, must not attend school as long as the house is considered to be infected.

Dr. Janssens, director of the Bureau d'Hygiène, employs a very ingenious method for obtaining a clear statement of infectious diseases. A plan of the town on a large scale, mounted on thin cardboard, is placed on an easel. Pins of different colours are placed over each house where infectious diseases have appeared. Black pins signify small-pox; red, scarlet fever; yellow, typhus, and so on. To distinguish new cases on subsequent days, the new pins inserted are of half the size of those first inserted.

Disinfection.—Sulphur fumigation is held in such high esteem in Brussels, that no attempt has hitherto been made to introduce the use of steam. The disinfection is purely domestic: there are no public

establishments for this purpose, except an office where persons coming from infected localities are disinfected.

Disinfection of a house and its contents is carried out as soon as the sick person has recovered, died, or is removed to the hospital. It is always carried out by disinfectors appointed by the Bureau d'Hygiène. The fumigations are carried out in accordance with the method described on page 71 ; the quantity of sulphur burnt is 20 to 30 grammes to each cubic metre.

The mattresses and pillows are unmade, and their contents exposed, in order to ensure thorough fumigation.

Articles without value are burnt, small ones in the fire-place of the sick-room, others at the gas-works of the town, where they are taken in a covered conveyance.

During the whole period of the illness, the dejecta are disinfected with a solution of iron sulphate or carbolic acid, of the strength of 2 to 3 per cent. All the linen used by the patient is boiled with a solution of zinc chloride, or with a mixture of 240 grammes of zinc sulphate and 120 grammes of common salt dissolved in a pail of water (coarse sulphate of zinc cannot be used for this purpose, as it contains some iron, and forms patches of iron-mould).

The closets and drains of the infected house are also disinfected regularly with solution of iron sulphate or carbolic acid. In addition, the scavenging department is communicated with, and thus the disinfection of the neighbouring sewers is secured. In order to have ready a sufficient quantity of solution of iron sulphate, a basket containing 50 kilogrammes of this salt is suspended in a cask full of water.

The corpses of persons having died of an infectious disease are wrapped in clothes soaked in a 2 to 3 per cent. solution of carbolic acid. The body is then immediately conveyed to the observation chamber of the mortuary at the Evère cemetery, outside the town, and is subsequently interred as soon as certain signs of death have shown themselves.

Each disinfection is made the subject of a special report.

Mortuaries and Cemeteries.—Brussels possesses two mortuaries, to which are conveyed corpses from confined houses. One of these, within the the town, only receives the bodies of persons not having died of an infectious disease ; all others are conveyed to the mortuary at the Evère cemetery.

In the town the journey is effected in a litter on wheels drawn by men belonging to the Burial Department, after requisition of the medical health officer and consent of the family. Except in cases of urgency, removal is only done in the evening.

In times of epidemic, the removal of corpses to the mortuary is compulsory, and so also in other cases where the medical health officer decides that it is necessary.

No corpse, without special permission, can be kept in the mortuary more than 48 hours after death. At the mortuary the corpse is enshrouded

and placed in a coffin. For removal to the mortuary, envelopment in bedclothes is regarded as sufficient.

The mortuaries are under the supervision of the Bureau d'Hygiène, which sees to their ventilation, disinfection, and general sanitary arrangements.

According to the municipal regulations, interment ought to take place at the end of 48 hours, but this interval may be shortened or lengthened by special order.

Prostitution.—Prostitution in Brussels is under very severe regulations. A commissioner and two officers, belonging to the police, have charge of this work, and special doctors make the necessary visits.

Prostitutes are inspected ordinarily twice a week, and additional visits are made if required. The medical inspectors belong to the Bureau d'Hygiène, and are not allowed to receive any payment from the women visited, nor from the keepers of the houses. They are also forbidden to inform these women or their servants of the nature of the disease from which they are suffering.

Each month the medical inspectors send to the Bureau d'Hygiène a report of the cases of disease found, indicating the nature of the disease and the organ attacked.

All women notoriously leading an immoral life, are obliged to be registered and visited. Before being registered, they must appear at the Police Office to be cross-examined. An official report is made of this inquiry, containing the accusations and answers. It is sent at once to the burgomaster and to the collège of aldermen, who alone can order the registration of a suspected person.

When a minor is concerned, the parents should be first informed and exhorted to keep their child from an immoral life. If a married woman is concerned, the husband is informed. In both cases, the female is still, until a new order is made, kept under inspection, and the surveillance of the police.

When a prostitute desires to be removed from the register, she makes application to the burgomaster and aldermen, who decide as to the reasons given. Marriage is regarded as a complete reason for erasure from the register.

Houses for the Working Classes.—The question of the housing of the working classes has been the object of lively interest to the government and in many Belgian towns. In some, Mons, Anvers, Nivelles, the Poor Relief Department has built important blocks of dwellings for the working classes. In others, as Liège, Tournai, Brussels, special companies have built dwellings of this description.

In some, charitable societies have spent large sums on this object. It is to these, that in the last-named towns we owe the formation of special companies for the study of the question of houses for the working classes.

The first great society for the construction of workmen's houses was

founded in Brussels, in 1868, with a capital of five million francs. The charitable administration shared in this to the extent of 1,300,000 francs.

The houses built by this Society are of two kinds, viz. :—

1. Small houses, grouped in fours, and each intended for one or two families ; 2. Larger houses, containing several tenements.

The houses of the first category are of two kinds: those occupying a surface of 22 mètres square, and consisting of a cellar, kitchen on the ground-floor, two rooms on the next storey, and a garret ; others covering 28 square mètres, and containing a cellar, kitchen and another room on the ground-floor, two rooms on the next storey, and an attic. Each of these houses has a garden measuring 100 mètres square.

The houses of the first category only let for a single family, the others can be occupied by two families.

In the large workmen's houses, the tenements consist of a kitchen and one or two other rooms. Each occupant has the use of an attic if required.

Since its foundation in 1888, the company has constructed six blocks of workmen's dwellings, comprising 306 houses, occupied by 526 families.

The workmen's houses are rented by the week, and are under the supervision of the Bureau d'Hygiène. All such houses must have a supply of water sufficient for the needs of the occupants.

There are also lodging-houses in Brussels, and the regulations require a space of 494 cubic feet for each person. Authority to keep such lodging-houses must be obtained from the Administration, and they are under the supervision of the Bureau d'Hygiène. If one of them is declared to be dangerous to health, the local medical committee can oblige the proprietor to execute the necessary improvements. In the event of refusal or neglect to comply with these requirements, the continued occupation of the house can be forbidden by the burgomaster.

School Hygiene.—There are no special laws in Belgium relating to school hygiene. The control of the sanitary state of schools devolves upon the provincial Sanitary Authorities.

At Brussels, Anvers, Liège, and Louvain, where there are Bureaux d'Hygiène, these have the sanitary supervision of schools in their respective districts.

Brussels possesses, under the direction of Dr. Janssens, such a well organized school hygiene, that it may be regarded as a model for other countries.

The general hygiene of schools is supervised by the Bureau d'Hygiène in the state and municipal schools. In the first, however, the control is not regularly exercised; it is confined to inspections as to the sanitary state of the schools and the measures to be taken against the spread of infectious diseases. For this purpose the Bureau d'Hygiène is the executive of the local committee. In the municipal schools, on the other hand, the supervision comprises the whole range of school hygiene, and enters into the most minute particulars.

All plans and schemes of schools, including their position, construction, opening, ventilation, warming, lighting, drainage, closets, etc., must be examined and approved by the Bureau d'Hygiène. As in all such questions, this Bureau acts in concert with the administration of public buildings.

For warming, a central system is employed in the new schools by means of steam apparatus, the ventilation being secured by the same means.

The closets are placed out of doors, and divided into compartments, each having a separate door. The fæces are received in troughs underneath, which are cleansed out each evening, entering directly into the sewer.

The government regulates, in all schools subsidized by the State, the programme and hours for study. Gymnastics receive careful attention. To supervise the hygiene of the municipal schools, there are five medical inspectors, each having his own district. An inspection is made at least once in ten days, and the class-rooms and other parts of the school ought to be examined as to their cleanliness, ventilation, warming, etc.

As soon as it is suspected that a child is suffering from an infectious disease, he is sent to the doctor of the school.

All cases of such diseases should without delay be brought to the knowledge of the Bureau d'Hygiène, and of the head master of the school. The Department takes the measures mentioned on page 255, and the head teacher is required to see that no children from infected houses are allowed to attend school, and that convalescent children are not allowed to return to school without a certificate that all the necessary measures have been taken against the spread of infection.

In addition to the diseases previously mentioned, children affected with contagious ophthalmia, or with whooping cough, are not permitted to attend school; but children living in the same house as a patient with whooping cough, if they have previously had it, may continue to attend school.

The home treatment of children is not part of the duty of the doctor of the school; this is done by the charitable societies.

In some cases, however, it is the duty of the school doctors to undertake the medical treatment of scholars, as, for instance, of children of feeble constitution, anæmic and scrofulous children, or children affected with some chronic malady which does not hinder them from going on with their lessons. The treatment has to be carried out in the school itself, the medicines being supplied by the charitable societies. To distinguish this from ordinary medical treatment, it is called *preventive medical treatment.*

When a child first enters school, his physical condition should be overhauled, including height, weight, etc. The results of this examination are checked from time to time, and entered on a certificate, of which the form is given below.

TOWN OF BRUSSELS.

No...... *School*..... *Medical Observations.*

Name of Family ...	...	Faults of Constitution	...
Christian Name ...	...	Condition of the Eyes	...
Nationality of Parents	...	,, ,, Teeth	...
Language Spoken ...	...	Any dental operations done	
Place of Birth ...	...	at the school ...	...
Date of Birth ...	...		

MEDICAL EXAMINATION.

Date of Observations ...	...				Re-vaccination practised at the school
Age	...				with / without } success
Height	...				Preventive Medical Treatment
Weight	...				begun ... ...
Circumference of Head	...				ended ... ...
Diameter of Head ...	...				result ... ...
Circumference of Chest	...				
Diameter of Chest ...	...				OBSERVATIONS.
Capacity of Lungs ...	...				
Strength	...				
Colour of Hair... ...	...				
,, ,, Eyes... ...	...				
Classification Number	...				

All children with defective teeth ought to present themselves once a month at the Sanitary Department, where their requirements are attended to by a dentist.

After each inspection, the doctor of the school ought to make a report to the Bureau d' Hygiène on the form given above, and at the end of the year he should supply a résumé of his work.

Once a month the doctor ought to give a short lesson to the upper classes of the school on some hygienic subject indicated by the head of the Bureau d'Hygiène. The lesson should not be longer than ten minutes. To give an idea of the subjects treated, the following may be quoted: the utility of vaccination, isolation in infectious diseases, disinfection, and such like. It is hoped that the ideas thus acquired by scholars will spread to their homes and profit others.

All male and female teachers receive a thorough instruction in hygiene. They ought to supervise its practice in schools, the doctor only controlling and directing them. They are required to note on a table the temperature of each room four times a day, at 8.30 and 11 a.m., 2 and 3.30 p.m. This table is hung up in the hall beside the thermometer, and at each inspection the doctor ought to examine it.

In order that every infectious disease may be promptly discovered, the head of the school ought to take note of every indisposition which arises among the scholars. The symptoms of the onset of the various infectious diseases are set forth in a pamphlet prepared by the Bureau d'Hygiène for the use of schools.

Workmen's Dwellings.—The law of the 9th of August, 1889, gives regulations for ensuring the healthiness of workmen's houses, and for the formation of *comités de patronage* for the supervision of this law.

A regulation of the 12th of July, 1891, gives the method of operation of these comités and their relation to the government, the provincial and communal administrations, and the medical commissions.

FRANCE.

CHAPTER I.

SANITARY ADMINISTRATION AND LEGISLATION.

GENERAL SUMMARY.—SANITARY ADMINISTRATION.—General Control of the Public Health.—Councils and Local Committees of Public Health.—National Academy of Medicine.

SANITARY LEGISLATION.—Sale of Foods and Drinks.—Law relating to Insanitary Dwellings.—Protection of Infants.—Legislation respecting Unhealthy and Dangerous Establishments.—Laws on the Duration of Work.—Inspection of Factories.—Employment of Children and of Girls in Factories.—Legislation on Quarantine.—Other Sanitary Laws.

General Summary.—The French regard the foundation of the Royal Society of Medicine in 1776 as the first step taken in France towards the establishment of a public sanitary service. Although this association of medical men could not be regarded as a consultative authority, independent of the public authorities, it nevertheless exercised a very great influence on all sanitary questions on which the government requested their co-operation.

It was, however, reserved to the great Revolution to bestow on France a sanitary legislation. This was established by the laws of the 14th November, 1789, the 16th and 24th August, 1790, and the 28th September, 1791. These are the same laws which, after the conquest of Belgium by France in 1794, were introduced into the former country, and formed the basis of its subsequent sanitary administration.

These laws were found to be insufficient to improve the general state of the public health. Admitting that the chief cause of this was that at that period hygiene had not become a complete science, it must be owned that the complete surrender of public hygiene to the care of local communities could not give satisfactory results. For, on the one hand, it is impossible, even in the most favourable circumstances, to find in every district persons competent to organise the sanitary service; and on the other hand, experience has long ago shown that excessive decentralisation of sanitary administration does not produce the desired results. Ignorance and personal interests are forces which oppose with too much success the necessary measures.

These laws, nevertheless, led to some communities interesting themselves in the public health.

Thus *Conseils d'Hygiène Publique* were established in Paris in 1802, in Lyons 1802, Marseilles 1825, Lille and Nantes 1828, Troyes 1830, Rouen and Bordeaux 1831. These councils accomplished all that was then possible. It is only in recent times that the provisions of the old

laws have been profitably used, by the creation in many towns, as Nancy, Rheims, Lille, Havre, Pau, etc., of Bureaux d'Hygiène analogous to those in Brussels.

In 1822 the *Conseil Supérieur de Santé* was created under the control of the Minister of the Interior; but this council does not appear to have displayed much activity.

The Revolution of 1848 gave France its present sanitary organization by the decree of the 10th August, 1848, signed by Cavaignac, and countersigned by Thouret. This decree suppressed the *Conseil Supérieur de Santé*, and replaced it by the *Comité Consultatif d'Hygiène Publique de France* under the Minister of Commerce. The supreme control of public health was transferred on 1st January, 1889, to the Minister of the Interior. On the 18th December, 1848, the establishment for each department and district of a *Conseil d'Hygiène Publique et de Salubrité* was decreed.

This system would be excellent, if the police had not retained a chief control over sanitary matters, and if the councils had not been reduced to mere consultative committees without the right of initiative. They have not even the right to meet, unless called together by the prefect, who has no special knowledge of sanitary matters; and yet it is for him to decide whether questions of health shall be examined by a competent authority or not. In some departments, it has happened that the councils of health have not met once in the course of a whole year.

France possesses no general sanitary law. Most of the sanitary regulations in force consist of ministerial decrees, and orders of prefects and councils of health.

The Minister of the Interior in February, 1892, brought before the Chambre des Députés a project of sanitary law, of which the chief regulations are as follows:

Each commune must make necessary works of improvement and provide potable water of good quality in sufficient quantity.

Each owner must execute the necessary repairs to premises dangerous to health.

No house can be built without the sanction of the mayor, proving that the requirements of health have been observed.

Vaccination and re-vaccination are made obligatory.

In every commune the mayor is required to make sanitary regulations, approved by the prefect in accordance with the advice of the Conseil d'Hygiène of the département.

SANITARY ADMINISTRATION.

General Control of the Public Health (*Decrees of the 10th August, 1848, 30th September, and 30th December, 1884, 5th January, 1889*).

The head of the public health service in France since 1st January, 1889, is the Minister of the Interior.

Next to him comes the *Comité Consultatif d'Hygiène Publique*, whose function is to give advice and report on questions submitted to them, relating to—

1. Quarantines and their organisation;
2. Measures to be taken to prevent and suppress epidemics, to ameliorate

sanitary conditions of the population, whether manufacturing or agricultural ;

3. Extension of vaccination ;

4. The improvement of mineral water resorts, and means for rendering their use more accessible to persons of limited means ;

5. The formation and organisation of councils and committees of health, whose annual reports the consultative committee examines, and presents a summary to the Minister ;

6. The medical and pharmaceutical police ;

7. The health of mills and manufactures ;

8. Questions concerning workshops in towns and the departments.

The Comité in addition indicates to the Minister the questions which it thinks ought to be submitted to the National Academy of medicine.

Each year a report on the work of the Comité, and the sanitary improvements which have been effected, should be published.

The members of the Comité Consultatif, originally seven in number, have been gradually increased. In accordance with the decree of the 30th September, 1884, the present number is 23.

The following are *ex-officio* members of this Committee :—

1. The superintendent of the consulates and of commercial affairs to the Minister of Foreign Affairs ;

2. The president of the Council of Health of the Army ;

3. The president of the Council of Health of the Navy ;

4. The director-general of customs ;

5. The director of the general administration of poor relief ;

6. The superintendent of domestic commerce to the Minister of Commerce ;

7. The inspector-general of the sanitary services ;

8. The inspector-general of the veterinary schools ;

9. The architectural inspector of public works.

The other members, of whom at least 8 should be medical men, are chosen by the Minister. When one of these retires, the Committee submits a list of three persons from whom the Minister makes his choice.

The president and vice-president are nominated each year by the Minister from the members of the Committee. The Minister also chooses the secretary, who has a vote in the meetings.

The Minister has the right, if he thinks it necessary, to call in specialists to the Committee with power to vote.

The Committee meets at least once a week. The members divide into sub-committees for the study of questions. The constitution and number of members of these sub-committees are determined by the president.

For the direction of urgent sanitary matters, the Minister has near him a Council consisting of the president of the Comité Consultatif, the inspector-general of the sanitary services, the professor of hygiene of the faculty of medicine of Paris, and the superintendent of commerce.

The members of the Committee receive payment for each meeting. A

laboratory has been placed at the disposal of the Committee intended to educate hygienists and health officers.

Conseils and Commissions Locales d'Hygiène Publique (*Order of the 18th December*, 1848).—Each district must have a Council of Public Health. The number of members varies from 7 to 15; they are nominated by the prefect for four consecutive years, one-half being newly appointed every two years.

Health Committees can also be instituted in the chief towns of the canton, if the prefect decides on this, after having consulted with the Council of Health of the district.

At the head of each département is a Conseil départemental of Public Health, whose members are also appointed by the prefect. The prefect or the sub-prefect presides over the Councils in the départements and districts. In the chief towns of the canton the mayor is the president of the Committee, and the Council or Committee chooses its own vice-president and secretary for the period of two years. The ordinary meetings should be held every three months at least, and at any other times when they are convened by the authorities.

The Committee of a chief town of the canton can be called to sit with the Council of Hygiene of the district, its members having a deliberative voice in it.

The district Councils of Hygiene are charged with the care of those sanitary matters relating to the district, which are referred to them by the prefect or sub-prefect. They can be specially consulted on the following subjects :—

1. The sanitation of localities and of houses.
2. Measures to be taken to prevent and suppress endemics and epidemics.
3. Measures to be taken to prevent and suppress epizootic diseases and other diseases of animals.
4. The spreading of vaccination.
5. The provision of medical help to the indigent sick.
6. Means for improving the sanitary condition of industrial and agricultural populations.
7. The health conditions of workshops, schools, hospitals, lunatic asylums, charitable institutions, barracks, arsenals, prisons, relief offices, asylums, etc.
8. Questions relating to foundlings.
9. The quality of foods, drinks, condiments, and medicines used in commerce.
10. Improvement of mineral-water resorts belonging to the State, to départements, communities or individuals; means for rendering their use practicable for poor persons.
11. Applications for opening, removing, or closing dangerous or unhealthy establishments.
12. Great works of public utility affecting the public health, as the con-

struction of houses, schools, prisons, barracks, harbours, canals, reservoirs, fountains, halls, markets, sewers, cemeteries, and places for macerating hemp.

The Councils of Public Health for districts ought to collate the documents relating to mortality and its causes, to the topography and sanitary statistics of the district. These should be sent regularly to the prefect, who transmits a copy to the Minister of the Interior.

The Council of Hygiene for the département is required to adjudicate on the sanitary questions interesting the whole département or several districts of it. It ought similarly to present an annual report, accompanied by a résumé of that of the districts. This document is sent to the Minister by the prefect.

The members of these Councils ought, as far as possible, to consist of 4 to 6 medical men, 2 to 4 chemists, 1 to 2 veterinary surgeons, and 3 persons chosen from among the chief agriculturists, merchants or tradesmen. In addition, engineers, architects, and other specialists of the département are consulted on certain questions.

Some départements have created *sanitary inspectors* for the control of the public health. These are hygienists having received a scientific education, and they effect much good by the counsel and advice which they have the opportunity to give. But a decision of the Council of State has considerably reduced their scope of action and diminished the desire to make use of them ; as it states that these inspectors can only exercise their functions with the consent of the local authorities.

By the regulation of the 2nd May, 1805, each district ought to have a medical adviser as to epidemics, nominated by the prefect. He is required to give an annnal report to the Government of the discharge of his duties, and of the sanitary state of his district. These reports are transmitted to the Academy of Medicine, by whom they are summarized in a statement of the general sanitary condition of the country.

In accordance with the law of the 1st September, 1851, the medical adviser as to epidemics is *ex-officio* a member of the Council of Hygiene of the district.

The inspection of drugs and medicine is by the law entrusted to certain members of the Council of Hygiene nominated by it. At Paris and Montpellier only this charge is in the hands of the Superior Schools of Pharmacy.

National Academy of Medicine.—As in Belgium, the National Academy of Medicine of Paris, forms part of the sanitary administration. It was created by the State in 1820, and it is the highest scientific authority from the medical and hygienic standpoint. It often takes the initiative in the study of these matters, and the Minister refers sanitary questions to it for advice.

The Academy of Medicine has the supreme control of vaccination, and possesses a station in which to practise it. It possesses in addition a library, laboratory, etc.

When so directed by the government, the Academy appoints certain of its members to visit localities infected by an epidemic or epizootic, mineral water resorts and other public establishments.

It also distributes a large number of prizes for scientific works.

SANITARY LEGISLATION.

Sale of Foods and Drinks (*Laws of the 16th–24th August*, 1790; *17th–22nd July*, 1791; *18th July*, 1837; *27th March*, 1851; *penal codes of military and naval justice*).—It is forbidden under penalty of a fine to put on sale any food which is adulterated, spoilt, damaged, or unfit from any other reason for food. The same holds good for every fraud as to the quality of any merchandise.

If the adulteration is of such a nature as to endanger health, the penalty is more severe.

It is equally forbidden, under pain of confiscation, to keep, without valid legal reason, damaged or adulterated foods or drinks in stores, shops, workshops, or other places of sale. The portions of the confiscated foods which are still fit for food are sent by the Administration to some charitable society; those unfit for food are destroyed at the cost of the offender. The tribunal can order the destruction in such a case to be publicly carried out in front of the house or shop of the offender; and can also, if it thinks fit, order the judgment to be publicly posted at convenient spots, and inserted in full, or summarised in the daily papers; these things being done at the cost of the offender.

Carriers and boatmen adulterating the substances entrusted to them, are liable to a fine or imprisonment.

The mayor of the district is charged with the duty of ensuring compliance with the laws relating to food and drinks. In Paris and the département of the Seine, this obligation rests on the prefect of the police.

Law relating to Insanitary Dwellings of 13th April, 1850.—*Modifications of the 25th May*, 1864.—In every town in which the Municipal Council has declared it necessary, it appoints a Committee to find out the necessary measures for the improvement of insanitary houses.

The Insanitary Dwellings Committee consists of 5 to 9 members. In towns with a population over 50,000, the Municipal Council may either appoint several Committees, or increase the number in the existing Committee up to 20. In Paris the number may be 30. Among these members there must be a doctor, an architect, as well as a member of the poor relief office, and of the council of experts, if the latter exists in the town. The mayor or his assistant is the chairman; in Paris, the prefect of the Seine.

The doctor and architect may be chosen from without the town.

A third of the Committee retire every two years; the out-going members are eligible for re-election.

The Committee visits places stated to be unhealthy, determines their exact condition, and indicates the causes of the evil and the means for

remedying it. It also indicates what houses are incapable of being rendered fit for habitation. The reports of the Committee must be sent to the mayor's secretary, and the interested parties compelled to attend to the matter, and to produce a statement within a month.

At the expiration of this time, the statements and reports are submitted to the Municipal Council, which determines the houses not capable of being rendered sanitary, the work required, and the details as to its execution.

An appeal is open to the interested parties to the Council of the Prefecture within a month from the date of receipt of the municipal order.

If it is found that a dwelling cannot be rendered sanitary, and that the causes of the insanitary condition are inherent in the house, the Municipal Authority can provisionally forbid its occupation as a dwelling.

The final order for closure can only be made by the Council of the Prefecture; and in this case an appeal may be made to the Council of State.

When, through the enforcement of this law, the cancelling of any entertainments has been brought about, the occupier cannot claim any compensation for loss.

When unhealthiness is the result of external permanent causes, or when it cannot be remedied except by combined operations, the Council may acquire the whole of the property included within the limits of the necessary work.

All fines inflicted in carrying out this law are handed over to the authorities or to a charitable institution in the locality of the houses in connection with which fines have been incurred.

Protection of Infants (*Law of the 23rd December*, 1874).—Every infant, under two years of age, who in consideration of payment is placed by his parent out to nurse, comes, by this fact, under the supervision of the public authority, with a view to the protection of its life and health.

The supervision organized by the present law is entrusted in the départements of the Seine to the prefect of police, and in other départements to the prefects.

These officers are assisted by a committee, whose duty it is to study and propose any measures to be taken, and is composed of the following:—

Two members of the General Council, appointed by this Council; in the département of the Seine, the superintendent of public relief, and in the other départements, the inspector of the department for the relief of children; six other members appointed by the prefect, of whom one is chosen from among the medical members of the Departmental Council of Public Health, and three from among the administrators of the legally recognised societies for children, especially the *Societies for the Protection of Children*, the *Societies for Maternal Charity*, *Crèches*, or *Societies for Crèches*; or failing these, from among the members of the committees of hospitals and charitable associations.

Local committees are appointed, by order of the prefect, on the recommendation of the départemental committee, in parts of the département where they would be useful, to take the necessary measures to protect children and exercise surveillance over their guardians and nurses.

Two matrons are found on every local committee.

The duties carried out by these committees are not paid for.

The Minister of the Interior has organized a superior committee for the protection of infants, whose function is to summarize the reports furnished by departmental committees, to present to the Minister an annual report of the work of these committees, of the mortality of infants and the most appropriate measures to ensure and extend the beneficent action of the law, and to propose, when occasion arises, the giving of honorary rewards to persons who have distinguished themselves by their devotion to this work.

A member of the Academy of Medicine, nominated by the Academy, the presidents of the *Paris Society for the Protection of Infants*, of the *Society for Maternal Charity*, and of the *Society of Crèches* form part of this committee.

The other members, to the number of seven, are appointed by the President of the Republic. The duties are entirely honorary.

By instruction of the Minister of the Interior, there is published each year a detailed statistical statement of the mortality of infants under one year of age, and particularly of infants placed out to nurse.

In addition, the Minister addresses an official report each year to the President of the Republic on the administration of this law.

In the départements where the establishment of a system of medical inspection of children in nursing establishments is recommended by the Minister of the Interior, one or several doctors are appointed for this purpose. The appointment of these inspectors is in the hands of the prefects.

Every person placing a child out in charge of a paid nurse, is obliged to make a declaration of this fact to the mayor.

Every person wishing to procure a foster-child, or to take the charge of one or more infants, is obliged to furnish beforehand the certificates required by the regulations indicating his civil state and showing his or her fitness to receive children.

Every person wishing to act as nurse must be furnished with a certificate from the mayor, giving her residence, and stating whether her last child is living and more than seven months old, or if it has not reached this age, that it is suckled by another woman carrying out the regulations of the public administration.

Every person who has received for payment a foster-child or child requiring to be nursed, is required under pain of the penalty prescribed by the 346th article of the penal code:

1. To make a declaration of his address to the mayor of the town, within three days of the arrival of the infant;

2. In the event of change of address, to make a new declaration to the mayor;

5. To announce, within the same period, the withdrawal of the infant by his parents, or his delivery to another person, and the cause of this;

4. In the event of death of the infant, to announce the fact within 24 hours.

A special register is kept in the mayor's office for the above required declarations. This register is numbered, initialled and verified each year by the magistrate. He gives an annual report of his examination of the register to the Procureur of the Republic, who transmits it to the prefect.

If the register is missing or kept irregularly, the mayor is liable to the penalty prescribed in the 50th article of the civil code.

No one can open or direct a registry of nursing establishments, nor act as an agent to arrange the placing of infants out to nurse or hire nurses, without previous authority from the prefect.

A regulation of the public administration (dated the 7th February, 1877) determines—

1. The methods of organising the system of inspection instituted by the present law, the organization of the medical inspection, the powers and duties of the medical inspectors, the salary of these inspectors ;

2. The obligations imposed on nurses, on the managers of registry offices and all agents for the placing out of infants ;

3. The form of declarations, records, certificates of mayors and of doctors and other requirements of these regulations.

The prefect can, after consulting with the Departmental Committee, make special regulations bearing on local requirements.

The expenses incurred in putting this law into force are charged one half to the State and one half to the departments interested.

The share charged to the départements is borne partly by the départements in which the infants were born, and partly by those in which they are nursed.

Legislation respecting Unhealthy and Dangerous Establishments.—The French legislation respecting industrial establishments is divided into three parts, dealing with unhealthiness, incommodiousness and dangers.

The first class comprises establishments which should not be built in the neighbourhood of dwelling-houses.

The second class comprises those which need not be distant from houses but in which special measures must be taken to prevent persons in the neighbourhood from being subject to nuisance.

The third class comprises those which do not cause special nuisance, but still require control.

Opening and erection of these establishments (*Decrees of the 15th October*, 1810, *and the 3rd May*, 1886).—The application for the opening of a factory of the first class is forwarded to the prefect, who transmits it to the mayor of the town ; it ought to be accompanied by a plan to the scale of 1 in 2,500, comprising a circuit of 500 metres. The mayor is bound to affix this application for a month in all the parts situated within 5 kilomètres of the proposed factory. All those wishing to do so can during this time make objections to the mayor, either verbally or in writing.

The month having expired, the mayor should forward to the prefect an official report of the opinions expressed, and the decision of the Council of

Health for the district. In the event of objections being raised, the Council of the Prefecture is consulted, and then the prefect announces his decision.

If the prefect allows the premises to be opened, the authorization should name the measures to be taken from a sanitary standpoint to avoid accidents to the workers or neighbours.

An appeal may be made from the decision of the prefect to the Conseil d'État.

Applications for the opening of factories of the second class are made to the sub-prefect, who forwards them to the mayor; they ought to be accompanied by plans representing the neighbourhood for a radius of 200 metres. These are publicly exposed only in the town where the factory is to be established, and only inhabitants of this town can raise objections. The prefect decides such cases without consulting the Conseil de Préfecture, but the Conseil d'Hygiène gives its advice on the matter.

The permission to open a factory of the third class is given by the sub-prefect after consulting with the mayor and the local police. Applications should be accompanied by plans of the vicinity within a radius of 100 metres. Objections to the application are adjudged by the Conseil de Préfecture.

If the manufacturer does not carry out the conditions given in his licence, or the operations are delayed for more than six months, the licence is void.

If the manufacture causes serious discomforts not foreseen, the licence can be withdrawn by a special decision of the Conseil d'État.

By the decree of the 9th February, 1867, special regulations are in force for gas-manufactories, dealing with the ventilation of the workshops and the effective purification of the gas.

Laws on the Duration of Work (*9th September*, 1848, *16th February*, 1883).—The day's labour in factories ought not to exceed twelve hours. The administration may grant exceptions to this rule in certain cases.

Infractions of this law are punished by fines of 5 to 100 francs for each workman; but they should not exceed 1,000 francs for a single offence. The 463rd article of the penal code can always be enforced at the same time.

The local committees and inspectors are bound to supervise the carrying out of this law (see below).

Inspection of Factories.—Except in the département of the Seine there is no factory inspection in France. It is left to the prefect and the mayor to see to the carrying out of the regulations for each factory, assisted by the local authorities.

If the nuisances are excessive, the Conseil de Salubrité is consulted, but its advice possesses no legal validity. Although effective measures have not hitherto been taken in France to ensure the sanitation of factories, this is because it is very seldom that nuisances are complained of other than those affecting persons in the neighbourhood of the factory.

The labour of children in factories is supervised by special inspectors.

Mining engineers have the supervision of steam engines.

Employment of Children and of Girls in Factories (*Law of the 3rd June* 1874, *Law of the 9th November,* 1891).—The employment of children under thirteen years is forbidden in factories, and no children are allowed to work more than twelve hours a day.

Children under 15 years of age who cannot show that they have attended school, are only allowed to work for six hours, and must attend school.

The administrative authorities can, however, give permission for the employment of children from ten to twelve in certain industries; but in such case the child must attend school for at least two hours daily.

The duration of work, including meal-time, must not exceed six hours.

Until they have reached the age of sixteen years, children are not permitted to work at night, that is, between 9 p.m. and 5 a.m. The same applies for girls up to the age of 21 years, who are engaged in workshops and factories; but some exceptions are made to this rule.

Boys under 16 and girls under 21 years of age are not permitted to work on Sundays and holidays.

The employment of women in mines is forbidden, and boys under 16 years can only be employed under certain conditions.

It is the duty of mayors to send to parents and guardians a small book in which is stated the Christian name and surname of the child, his residence, the date and place of birth, and the time during which he has attended school.

The master or manager of the factory must enter in this book the date of entry and departure from their works, and must also keep a register of the same facts. This regulation is affixed to the workshop walls, as well as the rules made by the government as to the kinds of work forbidden to children on account of the accidents liable to follow from them.

Workshops should be kept clean and well ventilated; every possible means should be taken to protect children against accidents and insanitary conditions.

In workshops where machinery, wheels, leather straps, gear, etc. have been shown to be a cause of danger, they should be so separated from the workers that approach is only possible under certain conditions.

Shafts, trap-doors, and other openings must be kept properly secured.

The heads of the establishment ought, in addition, to see that good manners and decency are maintained in their workshops.

To secure the carrying out of this law, 15 divisional inspectors are appointed and paid by the State.

If an inspector detects any cause of danger or unhealthiness, he consults the Commission Locale.

The inspectors are required to publish annual reports.

In each département there should be a Commission Locale which superintends the carrying out of the law and controls the work of the inspectors. With this view they visit, with or without a medical man, the workshops and factories.

Each district should possess at least one such commission. It publishes an annual report on its work, which it forwards to the Minister of the Interior.

The Conseil Général has the right to appoint a special inspector, paid by the département, who is subordinate to the divisional inspector.

In relation with the Minister of the Interior, is a Commission Supérieure composed of nine members chosen by the President of the Republic. This is charged with—

1. Supervising the uniform and vigilant application of this law;

2. Giving advice on regulations to be made, and generally on the diverse questions affecting children in factories;

3. Finally, securing lists of candidates for the appointments of divisional inspectors.

Each year, the president of the Commission Supérieure should report to the government on the results of the inspections, and on all facts bearing on the carrying out of this law. This report should be published in the *Journal Officiel* and communicated to the Chambers along with a statement of the regulations of public administration which complete the law.

Legislation on Quarantine (*Decrees of the 27th May*, 1853, *22nd February*, 1876, *regulation of* 1874).—The French quarantine legislation is very prolix; the regulation of 1874 containing no less than 138 articles.

The precepts relate to three maladies: the plague, yellow fever, and cholera.

Among these precepts is frontier quarantine.

For the regulation of maritime quarantine, which is alone possible at the present day, the coast is divided into eleven districts, each possessing the necessary officers. The chief of the district or *directeur de santé* is a medical man. The services comprise officers, employés, and guards, varying in number according to requirements. In the ports there are chief agents, ordinary agents and sub-agents.

Each quarantine district has a *Conseil Sanitaire*, representing the local interests. Similar conseils may be formed in each important port.

The prefect, before sending to the Minister the schemes relating to measures to be taken, lays them before the Conseils Sanitaires.

Other Sanitary Laws—To the sanitary laws summarised above, must be added the following:—

The sale of poisons and of secret remedies (law of the 19th July, 1845; decrees of the 3rd May and 18th July, 1850). The law of the 14th July, 1856, on mineral waters. The decree of the 29th of December, 1851, on the sale of spirits. The ministerial circular of the 24th December, 1866, on interments. The decrees of the 12th June, 1804, 7th March, 1806, and 6th December, 1843, on cemeteries and burials. The circular of the 30th January, 1856, on the removal of corpses. The laws of the 22nd December, 1789, 12th and 20th August, 1790, 6th October, 1791, against the pollution of streams. The ministerial circular of the 15th March, 1873, and the order of March, 1834, on the maceration of hemp.

CHAPTER II.

PARIS.

General Summary. — Sanitary Organization. — Conseils and Commissions d'Hygiène and de Salubrité.—Sanitary Administration by the Prefects.—Poor Relief.—Municipal Observatory of Montsouris.—Municipal Laboratory.—Department of Municipal Statistics.—Police Regulations as to Manure Depôts, etc.—Regulations relating to Buildings.—Regulations concerning Lodging Houses.—Sanitary Arrangements respecting the Air.—Sanitary Arrangements as to Water Supply.—Sanitary Regulations respecting Provisions.—Inspection of Meat.—Control of Abattoirs.—Characteristics of Condemned Meat.—Central Halls.—The Sale of Milk.

General Summary.—No town has exercised so great an attraction on the whole civilized world as Paris. In respect of beauty, elegance, luxury, and intelligence, Paris occupies the first place among the cities of the world. From a hygienic standpoint, it must be admitted that most of the capitals of the world, as great as Paris, can scarcely equal it as to situation and climate; and not one is equal to it in abundance of parks, gardens, squares, and wide streets.

Paris is situated on the two banks of the Seine, 180 kilomètres from the sea. It covers an area of about 8,000 hectares. The ground rises gradually from the river to the outskirts of Paris. The river flows, during its course in the town, with sufficient rapidity to prevent stagnation.

The climate is mild, the air clear and transparent, and there are seldom fogs. Compared with a great number of other towns, Paris enjoys, from a sanitary standpoint, many natural advantages. But, contrary to what has occurred in other capitals of Europe, the great sanitary improvements which have been effected have not been followed in Paris by a constant fall in mortality.

Paris had a population in 1891 of 2,424,705. The death-rate per 1,000 inhabitants was—

In 1865–69	25·3
,, 1870–74	30·4
,, 1875–79	23·5
,, 1880–84	25·2
,, 1885–88	23·5
,, 1889	23·5
,, 1890	24·5
,, 1891	21·6

Sanitary Organization.—**Conseils and Commissions d'Hygiène et de Salubrité** (*Decrees of the 15th December*, 1851, *19th January*, 1852, *5th January*, 1861, *26th November*, 1878, *7th July*, 1880, *7th March*, 1881). To obviate the difficulties which always arise if the environs of a town are under a separate administration, the département of the Seine has been united, for sanitary purposes, with Paris.

The sanitary organization of the département of the Seine and of Paris differ in certain respects from that of other départements.

The prefect of police exercises authority over Paris and the whole département of the Seine. Next to him is the *Conseil d'Hygiène Publique et de Salubrité du département de la Seine*. This consists of eleven permanent members; viz., the dean of the faculty of medicine, the professors of public health and of legal medicine, the chief of the Bureau de Salubrité (4th bureau, 2nd division, prefecture of police), the chief architect of the prefecture, the chief engineer, etc. It contains also twenty-four titular members chosen by the prefect and approved by the minister of the interior.

The chief of the Bureau de Salubrité is the secretary to the Conseil. The Conseil only meets when called together by the prefect, as in other départements.

In each district of Paris is a *Commission d'Hygiène et de Salubrité*, resembling in its constitution the Conseils d'Hygiène of the districts in the provinces. These Commissions have not yet the same authority as the Conseils, but are restricted in power like the Commissions d'Hygiène of the chief towns in a canton. The Conseil d'Hygiène of the Seine has, in the whole département, the same authority as the Conseils of districts in other parts, the result being a greater centralization.

If he thinks it necessary, the prefect of police can appoint members of the Conseil d'Hygiène of the département to take part in the deliberations of the Commissions d'Hygiène of districts, which latter meet at least once a month.

It is their duty to acquaint themselves with all matters affecting the public health, and to submit to the prefect the schemes for sanitary improvement which they consider necessary. They ought also to co-operate in applying the law of the 13th April, 1850, relating to insanitary dwellings (p. 268).

They should prompt the formation of special Committees in towns for inspecting dwellings, and indicating their sanitary defects.

In times of epidemic, they must seek the aid of these Committees as soon as possible. They must make an annual statistical report of mortality and its causes, of the number of inhabitants of the district classified according to quarters and streets, business, habits, manner of life, wages, consumption of spirits, etc. These reports are sent to the prefect, who remits them to the departmental Conseil d'Hygiène.

Thanks to the power of initiative, which belongs to the Commissions and the departmental Conseil, sanitation is, in the département of the

Seine, better directed than in other departements, where everything depends on the prefect; although, even in this case, the meetings of the Conseil only take place on the invitation of the prefect.

Sanitary Administration by the Prefects.—The sanitary administration is under the control of the prefecture of the Seine and the prefecture of the police. The first supervises unhealthy dwellings, the removal of corpses, burials and cemeteries, water supply and scavenging. The second supervises lodging-houses, abattoirs, the municipal laboratory, the sick poor, dispensaries, hospitals, lunatics, asylums, mineral water establishments, stables and cow-houses.

For each of these departments there is a chief officer, with subordinates. The verification of births and deaths in each district is by civil doctors, paid by the State.

Poor Relief.—The care of the poor and sick belongs in Paris to the Assistance Publique, which, strictly, is a municipal administration. It is, however, also a part of the State administration, being under the prefecture of the Seine.

It is controlled by a responsible director, and comprises three divisions:—

1. Hospitals for treating the sick and relieving the poor;
2. Book keeping;
3. Abandoned children.

Like the benevolent societies of Belgium, the Assistance Publique accomplishes its work, in part, by means of gifts and liberal contributions; it also imposes taxes on theatres and other performances, the deficit in its resources being made good from the municipal treasury.

The colossal extent of this administration may be gathered from the fact that its annual expenditure has risen to more than thirty million francs, of which thirteen millions are provided by the town. The most expensive items are the hospitals, alms-houses, and asylums, comprising altogether accommodation for 22,000 persons.

The number of persons receiving relief outside the hospitals has risen to about 250,000.

Each hospital is controlled by a director, an officer of the administration. He has under him a manager, and the necessary staff. The medical staff occupy themselves only with the care of the sick.

The sick are received directly into the hospitals and to the central bureau of the Assistance Publique (avenue Victoria) for daily consultations; the physicians and surgeons of the central bureau attend to their wants.

The relief doctors attend to the poor and sick, who attend at the charitable bureau.

All the hospitals and asylums of the Assistance Publique are under a central municipal control. Their administration comes under seven divisions:—

1. *Laying in stores from the market.*—The Assistance Publique has, in the central markets (see below), a special bureau, with employés, pur-

veyors, stores, cellars, etc. Each morning, the hospitals send conveyances to receive their goods.

2. *Abattoir.*—The Assistance Publique has its abattoir in the municipal abattoir of Villejuif.

3. *Bakehouse.*—It makes purchases for the bakehouses, and grinds all the corn which is required.

4. *Wines.*—In the wine markets there is a special cellar for the Assistance Publique. This wine is analysed and carefully guarded.

5. A *Drug store*, which furnishes drugs for the dispensary of each hospital.

6. *Stores*, for dry materials; as corn, oatmeal, sugar, fuel, furniture, clothing, bedding, stores of bandages, etc. These last are usually made by the sick in hospitals and asylums who are still able to work;

7. *Central Office*, for the inspection of the sick and wounded.

Municipal Observatory of Montsouris.—In 1871 a meteorological Observatory was established at the cost of the State at Montsouris in Paris to examine the influence of atmospheric variations in agriculture, and in the state of the public health.

It contains three principal sections:—

1. Meteorology;
2. Chemical analysis of air and water;
3. Microscopic and micrographic analysis of air and water.

In 1876 the administration of the City of Paris requested that Observatory to make analyses in different parts of the town from a sanitary standpoint.

The works were executed under the control of a Commission chosen by the municipality. They comprise chemical and microscopic analysis of drinking water, sub-soil water, ground air, the air of sewers, and the air of different quarters of the city.

In order to give more importance to these studies, the municipal administration put at the disposal of the Observatory in 1879 a plot of ground, situated at Gennevilliers, that the utilization of the sewage water as manure and for irrigating fields might be studied there from the double standpoint of health and agriculture.

These meteorological, chemical, and microscopical studies were gradually extended, and, in 1884, a new station was established in the centre of Paris, near the Town Hall, rue Lobau, in order to observe the changes in the quality of air and water produced by town life.

These studies on the hygienic conditions of the town have finally absorbed the whole time of the Observatory of Montsouris. Since the 1st of January, 1887, the Observatory has ceased to be an establishment of the State, and now forms an intrinsic part of the sanitary institutions of Paris, being under the Prefect of the Seine. The Commission of which we have spoken continues to control and to inspect the working of the Observatory on behalf of the town.

Municipal Laboratory.—In 1876 a special Laboratory was created

near the "Prefecture de Police" for the inspection of foods and drinks. Two years later the control of provisions was added to it.

This Laboratory now employs fifty-five persons, of whom twenty-five are chemists, and twenty inspectors. The city is divided into ten districts, so that there are two inspectors to each district. Their duty is to inspect the markets and other places where foods are sold, of which they take samples, especially of any which seem to them suspicious, in order to subject them to analysis in the Laboratory. The public has also the right to transmit samples for analysis; the merchandise from which they are taken is finally checked by the specimens which the inspectors have themselves bought.

These analyses are qualitative and quantitative. The first are performed gratuitously, and the results are defined by the words—good, passable, not hurtful, or bad, adulterated, hurtful.

Those who desire to have quantitative results pay a fee of from five to twenty francs. Besides the above mentioned, the Laboratory performs all the investigations required by the Prefecture, the Custom-House, prisons, asylums, schools, the army, etc. All the analyses of air and water are, however, made in the Laboratories of the Observatory of Montsouris.

Department of Municipal Statistics.—Since 1880 Paris possesses a special department devoted to municipal statistics under the Prefecture. It publishes regularly a year-book of complete statistics, embracing all branches of the administration.

Strictly, speaking, the Bureau of Statistics only draws up the demographic parts. In order to collect the necessary information, a number of forms have been prepared, which are filled up by the mayors, and by the doctors having charge of the registration of births and deaths.

The registration of the causes of death is made by means of blank forms, on which each doctor notes the deaths which have occurred in his practice. These forms are afterwards compared with those furnished by the Medical Officer of Health. On these blank forms the following question is always found. Is the habitation unhealthy?

The Bureau of Statistics publishes a weekly report of municipal statistics, and also a monthly one. On it are written—meteorology, demography, the causes of death according to age and sex, the number under treatment in hospitals, and those attacked with dangerous contagious diseases, marriages, births, still-born, number of infants put to board by the municipality, cases of contagious disease reported by the doctors, deaths classified according to causes and according to localities, as well as a statement of population, area, the number of inhabitants per unit of area in each quarter, the plan of the city divided into quarters, showing the number of deaths from contagious diseases in each of them; lastly, a review of these deaths, with a comparative table for the preceding week.

A permanent Commission of Municipal Statistics, composed of the prefect as president, a number of town councillors, members of the Academy of Medicine and of the Institute of France, is requested to give advice for

the improvement of these reports, and of the general management. It meets once a month.

Sanitary Legislation.—Regulations of the Prefect of Police of December 24th, 1881, concerning the Depôts of Manure and other impurities in Rural Communes.

To prevent the accumulation of impurities in the suburbs of Paris, the prefect has published the following regulations, which are in force throughout the department of the Seine.

All accumulation of ordure in courts, gardens, or other enclosures belonging to a house, is forbidden.

Agriculturists who need depôts for manure can only have them by permission of the prefect of police and of the municipality. In any case these depôts must not be placed less than 200 metres from the houses, and 100 mètres from the public road.

At the time of manuring the dung must be buried as quickly as possible.

These regulations do not apply to the storage of impurities in towns where they are subject to the regulations relating to dangerous and insalubrious establishments, among which they are placed in the first class.

Regulations relating to Buildings (*Decrees of 26th March*, 1852, *23rd July*, 1884, *Police Orders of 23rd November*, 1853.)—Every builder, before beginning his work, must ascertain the line of frontage and level of the public road before his plot, and adapt his plans to it. He must also send to the administration a plan and sections of the contemplated building, and submit to the orders which will be made in the interest of the public safety and health. Twenty days after sending the plan and sections to the secretary of the prefecture of the Seine he may begin to work according to his plan, if he has not received any injunctions to the contrary. A geological section of the excavation for the foundation of the building must be prepared by every builder, and sent to the prefecture of the Seine.

The height of buildings by the side of the public roads in the city of Paris, is determined by the breadth allowed by law in those roads for buildings in line, and by the available width for buildings set back.

This height must not exceed the following measurements, taken from the footway or from the pavement at the foot of the façade of the building, including the entablature, attics, and all erections plumb with the front walls:—

20 mètres for public roads between 7·8 mètres wide.

15 mètres for public roads between 7·8 mètres and 9·74 in width.

18 mètres for public roads between 9·74 and 20 mètres in width.

20 mètres for roads (squares, cross roads, streets, quays, boulevards), 20 and more mètres in width.

The mode of measure indicated is not applicable to buildings on a slope, except those whose length does not exceed 30 mètres. Beyond that length the buildings must be lowered according to the declivity of the ground.

If the architect builds several detached houses, the height must be measured separately for each, according to the rules above mentioned.

The height of buildings bordering private paths, passages, blind alleys, etc., must be determined according to the width of these roads or spaces, in accordance with the rules fixed for ways or spaces adjoining the public roads.

Whatever the character of the buildings, more than 7 storeys above the ground-floor, including the *entre sol*, can never be allowed.

In all buildings the height of the ground-floor must never be less than 2·80 mètres measured from below the ceiling. The height of underground and other storeys must not be less than 2·60 mètres measured from below the ceiling. In attics this height of 2·60 mètres applies to the highest point of the slope.

In buildings of whatever kind, when the height does not exceed 18 mètres, the courts in which they open may serve for dwellings not having less than 80 mètres of surface with a mean width of at least 5 mètres.

Buildings in the public road higher than 18 mètres, having wings which do not exceed that height, must have yards possessing a surface of at least 40 mètres, with a mean width not less than 5 mètres.

When the wings of buildings are throughout higher than 18 mètres, the yards must not have less than 60 mètres of surface, with a mean width of 6 mètres.

Any small areas which have to light and ventilate kitchens, must have at least 9 mètres of surface, and a mean width of 1·80 mètres. All areas from which water-closets, entrance-halls, or passages, are exclusively lighted, must have at least 4 mètres of surface, with a width not less at any point than 1·60 mètres.

In the lowest storey of the main building, inhabited rooms may receive air and light from areas, on condition that these have a surface of at least 5 mètres.

Glazed roofs must not be put over yards higher than the openings for light and ventilation to rooms, kitchens, and water-closets, unless they are provided with sash-ventilators at the side, having openings at least a third of the surface of the yard or area, and ·08 in height.

The sash-ventilator is not obligatory for courts or areas which do not supply light and ventilation to living rooms, kitchens, or water-closets; but areas whose lower parts are not in communication with the outer air must be ventilated.

When several owners have entered into an engagement, through a notary, with the City of Paris always to keep in order their common courts, and these courts are one and a half times as large as the regulated amount, such owners are authorized to raise their buildings to a height corresponding to the said regulated surface. When many courts are joined together, the height of the inclosures must not exceed 5 mètres.

Houses must be provided with pipes and cisterns in sufficient number to carry off the refuse-water. These pipes and cisterns must be kept in

good order; they must be washed and cleaned as often as may be required, to prevent any nuisance.

Refuse-water must have a constant and easy outlet into the street, so that it cannot remain in courts or alleys; the waterspouts, and gutters for carrying away the water, must be washed several times a day, and kept in good repair. When the slope of the ground does not permit the water to flow to the road or the sewer, it must be received into cesspools constructed according to regulations.

Water-closets must be so arranged and ventilated as to prevent any odours. The floors must be impervious to wet and always kept clean. The drainage pipes must be in good order, and must not leak.

Underground drains are not common in Paris; it is only within the last 30 years that any have been built. There are therefore no regulations concerning them.

All regulations concerning buildings are under the control of the General Council of civil buildings. The Minister of the Interior may make exceptions in favour of edifices of an ornamental character if recommended by this Council.

Hygienists are unanimously of opinion that light should enter dwellings at an angle of at least 45° with the horizontal. It is estimated that the above-named rules do not satisfy those conditions.

The mode of building commonly employed in Paris has met with opposition, particularly from the architect E. Trelat, who, in a communication addressed to the Congress of Vienna, in 1887, says that the only effectual remedy for existing errors is the removal of the highest storeys.

Regulations of the Prefect of Police for the 25th of October, 1883, concerning Lodging Houses.

The letting of lodging-houses, whether of the whole house or a part, is only permitted after a declaration made to the Prefecture.

To this declaration must be joined:—

The certificate of the applicant's birth.

A certificate of good conduct, given by the Superintendent of the Police, or the Mayor.

The number of the rooms, their size, and the number of beds contained in each.

All lodging-houses must have a conspicuous sign; the rooms must be numbered.

The proprietor of the lodging-house must keep a register, in which he immediately enters the name of each lodger. This register must be paged by the Superintendent of Police.

Vagabonds, beggars and prostitutes are not allowed to lodge in these houses.

The rooms must be 2·50 mètres high, at the least; every lodger must have 14 cubic mètres of air. The number of persons who may occupy each room must be affixed to the wall.

The floors must be so arranged as to be easily washed, joints fitting

closely. Wooden boards must be painted in oil or waxed. The walls and ceilings must be plastered with plaster or mortar, painted in oil or lime-washed, every year if necessary.

Rooms in which there are only one or two beds may be papered. The paper must be renewed as often as necessary.

Rooms in which there are more than two persons must receive light directly from the outside.

No underground room can be let as a lodging without special authority.

There must not be less than one water-closet for 20 persons; it must be painted in oil and zinc white, kept clean, well lighted and ventilated from the outside. The floor must be impervious to wet. The seat of the closet must be hermetically closed.

Each lodging-house must be provided with a sufficient supply of water.

All lodging-houses are under the inspection of sanitary inspectors, doctors or architects, who have the right to enter them when they please.

If any one is attacked with an infectious disease, the lodging-house keeper must immediately inform the police; a doctor will then be sent to the place, who will direct the necessary measures, which the lodging-house keeper is bound to carry out. The inspectors address to the Prefecture a report of every visit. They also render an annual account of the results of their visits. They should visit all the lodging-houses in their districts at least once in the year. There are about 17,000 lodging-houses in the city of Paris.

Sanitary Arrangements respecting Air.—Since the year 1860, when the celebrated Haussmann, friend of Napoleon III., was prefect of the Seine, vast and magnificent works have been undertaken in order to secure the admission of pure air and light into the most confined parts of old Paris. The ancient labyrinths of narrow and crooked streets and lanes, have been replaced by splendid boulevards planted with trees, such as are not found in any other town in Europe. Since that time the system of open spaces has been carried out with perseverance. Paris is now surrounded by a double circle of boulevards; the inner one encircles the city on the two banks of the Seine, the outer includes a much more extended space, and represents very nearly the limit between the old town and the new.

Besides these circular boulevards, there are others which cross the city in different directions. In addition, superb avenues have been constructed, by which pure air penetrates into the interior of the city as through immense ventilating-tubes.

Of course, it is impossible to remedy in this way all the inconveniences caused by the old defective methods of building. Such great things have, however, been accomplished, that no other city can be compared with Paris in these respects.

The number of squares and parks is also more considerable, and they are better distributed than in most cities. The places De la Concorde, Vendôme, De la Bastille, the garden of the Tuileries, the Champs Elysées,

the Trocadero, the Parc Monceaux, the gardens of Luxembourg, of Plantes, and others are known to all the world. In the workmen's quarter there is the park of Buttes-Chaumont, and at the southern extremity of the town the Montsouris park; at the gates of the city the woods of Boulogne and Vincennes invite the inhabitants to breathe the pure air of the country.

In spite of these advantages the air is far from being pure in certain parts of Paris; this must be attributed to the excessive height of the houses, also to their being too much crowded together, and to the system of latrines, which is by no means adapted to the requirements of health.

As to ventilation, the central system of heating and ventilation generally followed on the Continent is usually employed in public buildings. These methods are too complicated, and the results are not always satisfactory. In the hands of careful persons they may prove efficient, but left to ordinary people, inconveniences arise which are not compensated by the advantages obtained. This has been long recognised by the English, a practical people, who therefore seldom employ them.

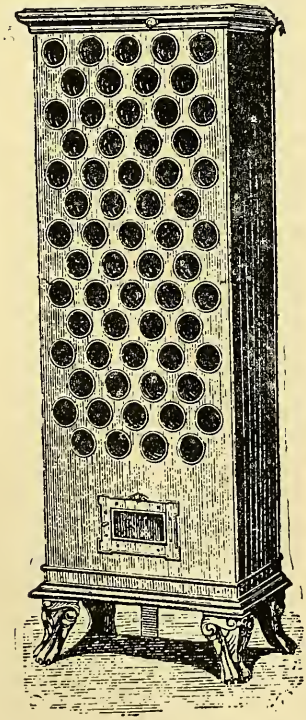


FIG. 87.—P. & E. SÉE'S GAS STOVE.

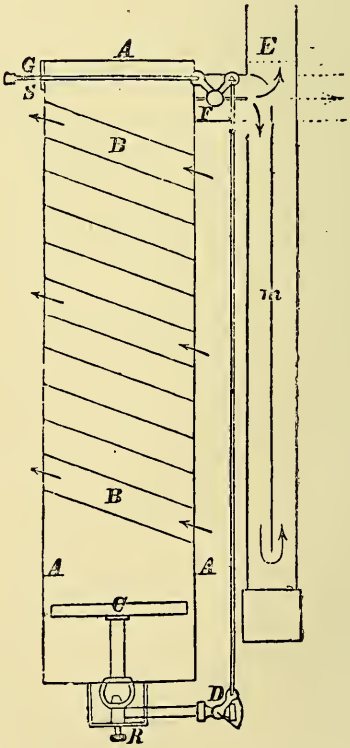


FIG. 88.—SECTION OF GAS STOVE.

However, next to the English, the French best understand the importance of good ventilation.

In all private houses, hotels, restaurants, and similar establishments, the air is excellent. Owing to an innate regard for cleanliness, even persons in poor circumstances generally manage to have pure air in their dwellings.

The windows usually descend nearly to the floor; they can be opened with a single turn of the hand. The chimney-pipe goes quite straight, having no angles. It is true that under these conditions the temperature of the rooms in winter leaves much to be desired, according to the ideas of inhabitants of the North; but this defect is compensated by the purity of the air, which is incontestably more necessary to health.

Of late, many movable sheet-iron stoves have been used, which can be removed from one room to another. They are furnished with a short flue-pipe, which can be inserted into the chimney.

Gas stoves are also used; Figures 87 and 88 represent one of this kind constructed by the sanitary engineers, E. and P. Sée of Lille. This consists of a case of sheet-iron, A, closed hermetically on all sides except the bottom, which is pierced with holes to admit the air necessary for combustion. The pipes B, in which the air circulates and is warmed, cross it obliquely from back to front. C is a row of Bunsen gas-burners; R a screw to regulate the current of gas. D the stop-cock. E the pipe which carries off the products of combustion; m is a partition within the pipe E. F is the key of the stove; G, the shaft moving the key F, which is fastened by another shaft to the stop-cock D. In this way the entrance of the gas and the exit of the products of combustion are regulated at the same time. S is a hook which keeps the shaft G in position.

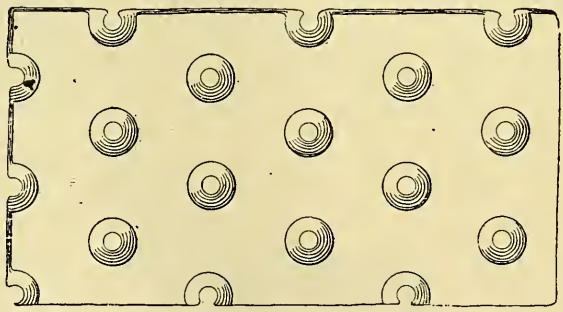


FIG. 89.—PERFORATED GLASS VENTILATOR.

The advantage of this apparatus for warming is that in a comparatively small space a large surface is heated. The air is warmed in it quickly, and yet not over-heated. For the introduction of fresh air there is a very simple and manageable mechanism of perforated glass. Figure 89 represents one form invented by the brothers Appert, and made by the house of Geneste, Herscher and Co. It is composed of plates of glass pierced with conical holes, the smaller end of which is outside, and the larger inside, the current of air being thus retarded in passing, and the air diffused gently through the room. There are 5,000 holes to the square mètre.

These glasses should be fixed in windows, at least 2·50 mètres above the floor. The rain which might enter by the apertures, flows away by means of a small groove placed in the sash between the glazing. The glass ventilator may be provided with another unperforated glass, fastened with hinges, which can be shut when necessary.

Another practical system of ventilation is that contrived by the engineer, Th. Sterné. It is a window-frame, to which are fastened valves of mica by means of small hinges.

The valves open and shut easily. This sash can be put in place of a square of glass high up in the window, or an opening in the wall can be made for it. In order that the ventilation may be complete, two ventilators are required, so that the valves of one open outwards, and those of the other inwards. A disk of glass is placed before the orifices, in order that the air may be diffused in all directions. By means of a screw arrangement, the orifices can be varied in size.

The following apparatus are more complicated, and certainly less efficacious. The *Cosmos hydraulic ventilator* consists of a bellows put in motion by the pressure of water. It may be placed vertically or horizontally, and the desired direction given to the incoming air by varying the pipes from which the water is allowed to discharge. This apparatus is recommended for restaurants, assembly-rooms, kitchens, water-closets, etc. The water which flows away can be employed for other purposes. It is hardly necessary to say that the apertures must be so arranged as to allow equal quantities of air to enter and escape from the room.

The shaft hydraulic ventilator, like the preceding, is put in motion by a jet of water, which under pressure becomes a jet of extreme tenuity. The air is rarefied in the pipe, producing an aspirating effect, which can be employed either for extraction or introduction of air. The amount of water used is about 15 litres to every 100 cubic mètres of air.

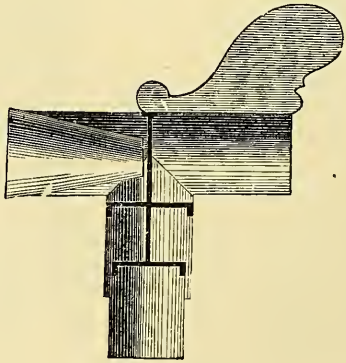


Fig. 90.—Fromentel's Aspirating Ventilator.

Fig. 90 represents the *Fromentel aspirator*, which is extensively used. It is constructed on the same principle as Honeyman's ventilator. A

rapid current of air in a narrow pipe placed horizontally over the outlet pipe produces an up-current of air in the latter. Fromentel's aspirator acts with much less power than Honeyman's ventilator. It requires strong currents of air, so that it is chiefly used for railway carriages. This apparatus is movable, and turns with the wind.

Sanitary Regulations Respecting Water. — The question of supplying Paris with drinking water has at all times occupied the attention of the government and the municipal authorities. At Belleville and Arcueil there are still remains of Roman aqueducts. The numerous laws relating to this subject show the interest taken in the question of the supply of water, and its importance from a sanitary point of view.

Before the Revolution of 1789, Paris possessed two kinds of water—the king's water (*eaux du roi*) and the water of the city. By a decree of 1807 the first named beeame the property of the city, and was placed under the same administration. The king's water was derived from sources situated to the south of the city, in the suburb of Arcueil, at a point at which one of the Roman aqueducts started at one time.

The water was conducted to a great reservoir near the Observatory, whence it was distributed to several fountains on the left bank of the Seine, and on the right back to the fountain Croix du Trahoir at the corner of the street Arbre-Sec, and the street Saint Honoré.

This conduit still exists, but its water enters the general system for the distribution of the water of the Seine. Near the Pont Neuf, there was once a pump, the "Samaritaine," built in 1606, and destroyed in 1812. It drew water from the Seine to the Louvre and the Tuileries.

At Chaillot and Gros-Caillou, the brothers Perier erected the first steam-pumps, in 1782, for the distribution of water from the Seine into different parts of the town. The one at Chaillot is still in use for the town service; the one at Gros-Caillou serves for the manufactories of tobacco at the quay d'Orsay.

The water for the city proceeding from the sources in the suburbs of Belleville, Saint Gervais, and Romainville, was brought to numerous fountains erected in Paris.

Part of this conduit is still employed for the service of the quarter of Belleville, another section has been abandoned to the commune of Pantin; but the greater part has been disused.

At one time the water was taken from the Seine itself, and from a considerable number of wells, of which 30,000 still remain, but the water is useless.

The actual service for the provision of drinking water, based originally on water taken from the Seine and from the canal d'Ourcq, was established by a private company, but since 1860 it has become the property of the city.

The increasing contamination of these river-waters rendered their use too dangerous.

It was therefore determined to supply Paris with pure water; but as it

was impossible to procure an adequate supply for all purposes, two systems of distribution have been adopted, one supplying unfiltered river-water for public use, fountains, watering streets, baths, lavatories, etc.; the other, pure water for household use.

The water proceeding from the Dhuis and the Varne arrives by two different routes.

The Dhuis is a small stream of water which falls into the Surmelin, one of the effluents of the Marne. It is from the Dhuis at a distance of 130 kilomètres from Paris that the aqueduct starts which brings 20,000 cubic metres of water every day to the reservoir of Ménilmontant on the right bank of the Seine.

This reservoir holds about 100,000 cubic metres of water.

The second system of water-supply collects water from several sources in the valley watered by the Vannes, one of the tributaries of the Yonne, which is an effluent of the Seine. The water is drawn directly from springs or collected in canals.

The most distant source is more than 150 kilomètres from Paris.

The aqueduct of Vannes brings 110,000 cubic mètres of water daily to Paris. It flows into a reservoir having a capacity of 250,000 cubic mètres, situated at Montsouris, on the left bank of the Seine.

These aqueducts and reservoirs are considered among the most remarkable works produced by engineers.

The aqueduct of the Dhuis has not a fall of more than 20 mètres throughout its course (130 kilomètres). This gives a fall of less than 15·4 per kilomètre. It is constructed in masonry, but where it crosses the valleys of cast-iron syphons.

The water reaches the city by gravitation.

In the valley of the Vannes the water is collected at different heights, so that pumps have to be employed. They are for the most part worked by the water which comes from the higher sources. After rendering this service the water enters the aqueduct with that raised by the pumps, and flows by gravitation to the city. The aqueduct crosses the valleys and ravines by means of syphons or in arcades.

The reservoirs, including the one at Montsouris, which covers a surface of 3 hectares, are in masonry, having two storeys, and entirely covered with earth. The upper storey contains water from the pure source, the lower one can be filled with water from the river when necessary. There are 15 reservoirs of smaller size, having a total capacity of 110,000 cubic metres.

They receive water from the rivers.

There are 6 elevators of water for the Seine, 2 for the Marne, and one for the canal d'Ourcq.

There are also three artesian wells which provide water—one at Grenelle, another at Passy, and the third at La Chapelle. This water, the temperature of which is 28° C., is brought by the pipes which convey the river-water. The water, like that at Arcueil, is inferior in quality, because it

contains so much chalk. The pressure is not strong enough to bring it inside the houses.

The quantity of water daily consumed in Paris is about 510,000 cubic mètres, of which 130,000 come from the Dhuis and the Vannes. The 380,000 other cubic mètres are furnished by the Seine, the Marne, the Ourcq, the artesian wells, and the aqueduct of Arcueil. The total gives about 200 litres of water to each person per day.

In the streets there are about 600 water-posts which distribute water from the source; most of them are provided with automatic stop-cocks.

The pipes inside the houses usually bring only water from the source; each inhabitant receives 45 litres per day.

The distribution is made by a stop-cock provided with a metre or gauge, the cistern being placed in the roof. The consumption at the stop-cock is calculated at the rate of 45 litres per day for each person, in dwellings which have but one stop-cock, and 33 litres for the other stop-cocks when there are several. In either case the owner pays for the water, and the occupier may use it at discretion.

The annual prices for water from the source are 120 francs per cubic mètre per day; 60 francs for 500 litres; 40 francs for 240; and 20 francs for 120 litres.

Owners are not obliged to furnish a supply of water for their houses, but if they desire to do so, the town will fix the pipes at the public cost. The occupiers then pay for the family consumption at the rate of 16 francs 20 centimes for 3 persons, and 4 francs extra for each person in addition. But in order that the distribution may be carried out, it is necessary that the payments of the occupiers should represent a total of at least 32 fr. 40 centimes a year.

The water-pipes inside the houses are usually made of lead.

The quantity of water allowed for each person per day in Paris may appear considerable when compared with that given in many other cities. In Edinburgh 180 litres are provided, in London, 135; Vienna, 100; Brussels, 100; Berlin, 75; Leipsic, 150. It is true that not one of these cities employs relatively such enormous quantities for industrial and public needs, so that the amount of water for private use in Paris is really less than in other cities. This amount will be further increased when the system of water-closets authorized since 1887 becomes more general. Measures have therefore been taken to increase the provision of water for Paris by 240,000 cubic mètres. Each person will then have 170 litres of pure water a day at his disposal.

The employment of lead pipes for the distribution of water in the houses is no doubt injurious, but as a very small quantity of lead can enter the organism by this means, symptoms of acute poisoning are rarely manifested. It is also seldom that symptoms of chronic lead-poisoning can be traced with certainty to the use of lead pipes. However, it is certain that a great deal of dyspepsia, the origin of which is obscure, may be occasioned

by lead pipes, though it may also be caused by adulterated food. At the Congress of Vienna in 1887, M. A. Hasson, from Paris, brought to light a number of facts relating to the dangers of lead pipes in a very instructive manner.

Sanitary Regulations Respecting Provisions.—The sale of provisions is subjected to a more severe and effectual control in Paris than elsewhere. What has been said of the Municipal Laboratory (p. 279) will partly explain the manner in which this control is organized. Meat and mushrooms are examined by special inspectors.

The inspection of provisions in Paris is much facilitated by the custom-houses, through which everything passes before entering the city. All commodities which ought to be examined are taken directly from the custom-houses to the place of inspection under the supervision of the custom-house officers.

Inspection of Meat (*Police Regulations of the 13th October*, 1879).—All fresh meat exceeding 3 kilogrammes' weight in amount, and all salted or smoked meat more than 5 kilos. in weight, must be inspected when it enters the city. For this purpose inspection offices are placed at the gates of Saint Cloud, Ternes, Clichy, La Villette, Vincennes, Charenton, Italie, and Orleans.

If it is desired to bring meat into Paris after the regular hours by other gates than the above-mentioned, by railroad or by boat, it may be done on condition that the meat be taken, at the expense of the bringer, to the nearest abattoir or to the Central Halls, under the escort of a custom-house official, where it will receive the regular inspection.

Meat recognised as unfit for food is immediately seized, and destroyed at the cost of the owner; but the latter has the right of appeal to the courts if he thinks the seizure illegal.

If the owner of the condemned meat wishes to keep it for the manufacture of tallow, etc., he may obtain permission; but in that case the meat must be specially treated in the presence of the inspector, at the cost of the applicant. Numerous incisions are made in it; it is sprinkled with powdered charcoal and spirits of turpentine or ammonia.

If the owner of the meat protests against the seizure, and demands another examination, the meat is taken to the office of inspection in the Central Halls, and is again examined by one of the veterinary surgeons in the service of the Prefecture of Police, designated by the owner himself. If the meat be confiscated, either wholly or in part, the cost of the examination must be borne by the owner.

All meat, whether sold in slaughter-houses, markets, or butchers' shops, must be submitted to inspection. The same obligation is in force for the offal and the products of manufacture. This inspection must be made in every shop at least twice in the month.

The inspectors of meat are also entrusted with the examination of poultry, game, and fish.

A large number of private slaughter-houses were built in the outskirts of

the city in consequence of these vigorous measures enforced in Paris. These have been placed under the supervision of 10 special inspectors since 1883. Their jurisdiction extends over the whole of the department of the Seine.

Control of Abattoirs (*Regulations of the 28th of October*, 1829, *25th March*, 1830, *23rd October*, 1854; *Police orders of the 29th August* 1879).—It is forbidden to slaughter cattle and to dress the carcases in any other place than the abattoirs built and arranged for that purpose, which are under the supervision of the Prefecture of Police.

Pigs affected with "measles" must not leave the abattoir. Beasts dying during transport, killed suddenly through accident in the market, the railroads, the public roads, or at the cattle-breeders, must be taken to the nearest abattoir. An inspector will examine them, and decide whether the meat is to be sold or destroyed.

In all cases, the flesh of animals dying a natural death must be destroyed at the expense of the owner,

No beast can be slaughtered in a stable or a yard, except in cases of extreme urgency, ascertained by the inspector.

Calves and lambs dying a natural death must be destroyed in the slaughter-house itself, and not taken away from it on any pretext.

Beasts suspected of disease, and therefore placed under observation in the stables of the abattoir, must only be slaughtered in the presence of an inspector, who must examine the viscera.

Meat and offal must only be kept in the places appointed for that purpose. It is forbidden to withdraw them from inspection in any way whatever.

The meat of slaughtered animals is examined, and what is judged to be bad is confiscated.

In case of protest, the flesh and intestines of the animal are sent to a special place and examined by an expert. If the intestines are wanting, the protest is null and void.

If no claim has been made at the end of 24 hours, the meat is destroyed at the cost of the owner.

The meat seized or deposited with the inspectors is at their disposal, and must not be taken away or destroyed without an order from them.

All attempts to deceive the buyer as to the quality of the commodities, as, for instance, by the blowing up of meat, are punishable by a fine.

Condemned Meat; Its Characteristics.—The legal arrangements which form the basis for the inspection of meat in Paris, are the articles 475, 477, and 479 of the Penal Code, besides the law of the 27th March, 1851, in virtue of which the sale of adulterated or deleterious food is forbidden.

The flesh of animals suffering from fever is easily recognised in the abattoirs, where the beasts are examined as they stand, and their internal organs after slaughter. But serious difficulties occur in forming judgment as to foreign meat. The points relied upon by the veterinary inspectors

of Paris, whose scientific education is perfect, rest on observations carefully pursued during long years.

These points are the following :

1. The meat is red, more or less dark, and of a dull tint ;

2. The adductor muscle of the thigh has a grey, earthy or ochreish tint ;

3. The serous membranes of the abdomen and chest are furrowed with branchings of a leaden grey or livid colour produced by hypostasis ;

4. The suet and fat exhibit more or less vascular injection, giving them the appearance of being streaked with wine. At other times the fat has a peculiar colouring, like wax which has taken a smoky tint. This is noticed chiefly in the depressions between the lumps of fat.

5. A purplish discolouration of the loins. This sign is seldom wanting ;

6. A brownish or blackish discolouration of the soft parts of the vertebræ when dissected.

7. The veins contain more or less blood ;

8. The muscular tissue is less firm.

When one or other of the following indications is observed, the blood must be examined through a microscope.

If there is only a slight rosy vascular injection in the tissues beneath the skin, if the fat is white inside, the flesh firm, of good appearance, without infiltration, or abnormal odour, the meat is passed.

Any unpleasant odour shows that the meat is not in a normal condition. Such odour will be most perceptible at the incision of the muscles, particularly the adductors of the thigh and of the leg, and the great muscle under the shoulder-blade.

Sometimes, when a muscle of a dull brown or grey colour is cut, the section takes a pale-red colour on exposure to the air, which remains even after cooking the meat.

When this change of colour occurs, the section is covered with a glutinous serum. Bloody infiltrations of serum are also often noticed in the cellular tissue between the muscles.

Another most important and common sign is that in the change of colour many tints are assumed, so that the meat seems mottled. The dominant colours are pale rose, dark red, and grey. This last is seen chiefly at the edge of the muscles. It is in cutting the sartorius and pectoral muscles that these changes of colour are most noticeable.

The bundles of muscles near the bones have a pale-rose tint, while the others are dark-rose.

The presence of exudations in the lymphatic glands is also an important indication.

As to tuberculosis, the rule is that if the lymphatic glands are affected, if dropsy is present, seizure is imperative. It is so also if the tuberculosis has caused emaciation. Otherwise the parts invaded by tubercle only are condemned.

Considering the difficulty in ascertaining the presence of tuberculosis merely by examination of the meat, it is ordered that the pieces of meat examined should be, at least, of the size of one quarter, and that the lungs should be comprised in one of these pieces.

There is no examination for the discovery of trichinosis in Paris. At the time when scientific interest was much excited on this subject, the inspectors made microscopic investigations, but as not one case of trichinosis was found after 3,000 beasts had been examined, the researches have been abandoned. There is no reason to fear that disease in France, England or Belgium, as the people do not eat raw pork.

Central Halls.—In Paris as in London the wholesale traffic in provisions needing careful supervision, is centred in one place, the Central Halls.

At present, the market covers a space of 40,390 square mètres, but it will be shortly enlarged.

There are ten pavilions connected by covered passages. They are arranged in two sections, one of four, the other of six, separated by the wide Baltard Street. The pavilions and sections form a perfect square. Each pavilion is divided into a number of shops. Underground are storehouses and cellars.

The sections composed of four pavilions are at the left of Baltard Street. They are devoted to the sale of meat and offal, game, poultry, fruit and vegetables.

The larger section of six pavilions, is set apart for tubers, legumes, fish and shell-fish, butter and cheese.

The exchange is near the market. The wholesale traffic is conducted by brokers or auctioneers. It commences in winter at 6 a.m., in summer at 5 a.m. and ends at 9 a.m. A bell then announces the retail sale.

The inspection of meat at the market is made in the following manner:

Each piece of meat is marked with a number, hung on a hook, and then examined by the inspectors. The good pieces are marked with a V (*à vendre*), the doubtful are taken to a special room, there to receive a careful examination. After exact anatomical and microscopical investigation, the inoffensive portions are returned, but all the damaged or diseased parts are condemned. The condemned meat is used for the food of the wild beasts in the Zoological Gardens, or else it is destroyed as before mentioned.

After the Central Market, the market of St. Germain, near the Church of Saint-Sulpice, is the largest place for the sale of general provisions. The market of Porte Saint Martin is principally for the sale of poultry. The private shops in each quarter are organised in the same way as those in London and Brussels previously described.

The display of merchandise is nowhere better understood than in Paris. Even the meat is garnished with flowers and foliage.

The Sale of Milk.—A considerable part of the milk consumed in Paris comes from cowhouses within the city. They belong to the category of

classified establishments, for which special authorization is required, and are placed under the control of inspectors, whose business it is to see that the regulations given at the time the licence was granted are observed. These relate to the number of cows, ventilation, cleanliness, etc. The retail sale of milk is chiefly carried on in dairies which receive the milk either from cowhouses situated in the city, from wholesale merchants, or from great companies which bring the milk by railway.

Large dairies are included in the second class of offensive or dangerous trades.

They are subject to the following regulations :—

The dairies must be well ventilated.

The floors must be paved or cemented, so as to be impervious to wet, and must be supplied with a subterranean drain for carrying off refuse-water to the sewer.

The walls must be faced with marble or tiles, or cemented.

All wainscoting must be painted in oil.

The dairies must have an abundant supply of water, and the floors and walls must be frequently washed.

Pigs must not be kept.

The examination of milk is entrusted to inspectors, who are attached to the Municipal Laboratory. They do not make analyses, but select samples which they send to the Laboratory.

The following instructions are given to the inspectors by the Prefect of Police.

The samples of milk should be taken early in the morning, as the principal sale is over at 9 a.m.

They must be taken from cowhouses, dairies, wholesale and retail dealers. The retailers of suspected milk must submit to special surveillance.

If the inspector should arrive just as the wholesale dealer brings the milk to the retailer, he must take a sample from each.

The inspector must notice the taste and odour of the milk, and must take a sample from vessels which seem to him suspicious.

The milk must be stirred from top to bottom with a large spoon in such a way that all the parts are mixed. The sample must then be taken from the middle of the vessel.

Samples must be taken from the untouched vessels as well as those from which part has been sold already.

It is better to take a sample from every vessel.

If the retailer affirms that the milk is exactly as he received it from the wholesale dealer, the inspector must return the next day at the moment when the milk arrives, and the dealer must give him samples from the vessels before they have been opened. The inspector must then make a note of the manner in which they were closed and marked, and obtain any information that might be useful in case of a judicial inquiry.

If the retailer should confess on the spot that his milk is adulterated,

no sample need be taken, but an official report must be drawn up, of which he certifies the correctness. This official report is afterwards sent to the proper authority.

In cases where the confession of the vendor seems inadequate, a sample may be taken, which will serve to verify his statement.

All samples must be sent to the Laboratory on the same day, before noon.

CHAPTER III.

PARIS (*continued*).

Sanitary Arrangements respecting the Soil.—Paving and Cleaning Streets.—Removal of Household Refuse.—Sewers.—Collecting Sewers.—(System for the Left bank.—System for the North.—System for the Right Bank.)—Form and Design of Sewers.—Sewers from the Sanitary Point of View.—Fall and Cleansing of Sewers.—Drainage of Houses.—Private Branches of Sewers.—Arrangements relating to Waste Pipes from Houses.—Privies.—Water-closets.—Removal of Night-soil (Berlier's System).—Cesspools.—Utilization of Night-soil.—Fields for Irrigation at Gennevilliers and Achères.—Stables and Cowhouses.—Abattoirs.—Cattle Market at La Villette.—Precautions against Contagious Diseases.—Vaccination.—Isolation and Care of the Sick.—Ambulance Stations.—Hospitals.—Disinfection.—Mortuaries.—Cemeteries.—Habitations of Working People.—Hygiene of Factories.—Hygiene of Schools.—Monge's School.

Sanitary Arrangements respecting the Soil. Paving and cleansing of Streets.—Paris took the lead of all other cities in laying down pavements. According to the historian Rigard, the work was begun in 1185, by order of Philip Augustus. At first the paving was only composed of large blocks of stone, about a mètre square, placed side by side. It went on so slowly, that in the time of Louis XIII. half the streets in Paris were still unpaved. Paving did not become general till after the beginning of this century, and a more rational system has been adopted. The old system made use of paving stones, which still remain in most of the old quarters of Paris and in some of the new. The noise caused by the rolling of carriages on the pavement led to the macadamizing of the most frequented streets. But the refuse, the dust, the cost of maintenance, above all, the quantity of sand entering the sewers, made it necessary to adopt asphalte on a bed of concrete, and lately wooden pavements as in London (see p. 117).

This method of paving seems likely to supersede all the others. The interstices of the wooden pavement are filled up with cement. As the refuse of the streets of Paris falls directly into the sewers, they require cleaning out oftener than in other cities. This necessitates sewers of large diameter and a considerable consumption of water. A great deal of labour is required to keep them clean (see below).

The entrances into the sewers are placed at the side of the footway not far from each other. The openings for flushing are placed near them. For watering the large streets and squares long flexible pipes on wheels are employed.

When this method is not applicable, water-carts are employed (Fig. 92).

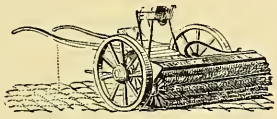


FIG. 91.—SWEEPING MACHINE.

The watering of narrow streets is effected by turning on the water, and then plugging up the opening into the sewer, and after sweeping allowing the dirt to escape into the sewer. The streets are washed at least once a day.

The sweeping of the streets is done in the morning, by hand-brooms, iron rakes, or india-rubber brushes. Also by means of sweeping machines (Fig. 91) resembling the horse-brushes used in London (see p. 117). The one represented here was invented by the engineer, Léon Blot. The same model is in use at Brussels.

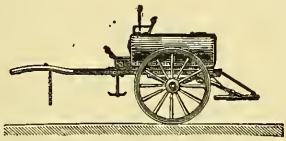


FIG. 92.—WATERING CART.

In streets where the network of sewers is not complete, the night-soil is taken away in carts.

Fig. 92 shows a watering-cask by the engineer Blot. It is provided with a winch or crank placed near the driver, who can thus let the water on or stop it as he pleases.

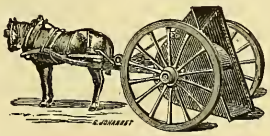


FIG. 93.—IRON DUNG-CART FOR REFUSE.[1]

Fig. 93 represents an iron dung-cart, Blot's system, for the reception of refuse from the streets, and for night-soil. It is also employed in Great Britain and Belgium.

Removal of Household Refuse.—The method used in Paris for carrying away this refuse, is the same as in Edinburgh and Brussels. The refuse is collected in boxes, and deposited on the pavements in front of the houses early in the morning. The carts pass and empty the boxes.

Before the end of 1884, all this refuse was put into the street in the even-

[1] This cart is particularly suitable for the transport of the semi-liquid remains of the intestines of slaughtered beasts. It is generally in use in slaughter-houses, as we have seen when those in Edinburgh were described (p. 214).

ing. The rag-pickers came and there collected rags, paper, bones, glass, etc. The refuse became scattered about the streets, thus rendering the collection more difficult. This custom was forbidden by a prefectoral decree of the 7th March, 1887.

The greater part of the refuse is taken to depôts outside the city, where it is allowed to decay for five or six months. At the end of this time it forms a valuable manure, which however is difficult to employ because of its enormous quantity. Part is taken away by boats, chiefly to Corbeil, up the river, and to Pontoise, down the river from Paris. The remainder is removed by railroad. These heaps, which accumulate every year, occasion much expense to the city. Some years a profit is realized, but on the average the loss amounts to a sum of two millions of francs.

Perhaps the easiest and cheapest way of disposing of this refuse would be to burn it, as is done in London (see p. 117). At present it is the business of contractors to remove it. The contracts are granted every third year.

Sewers.—The construction of sewers in Paris dates from 1663, but the oldest of those still in use are not earlier than the beginning of this century.

Before the great epidemic of cholera in 1832, the total length of the sewers was not more than 35 kilomètres.

The terrible ravages of that epidemic showed how urgent was the need for energetic sanitary measures. A much greater extension was at once given to the sewers. Between 1833 and 1839, not less than 8 kilomètres were constructed every year. From that date until 1856 the extension averaged 3 to 4 kilomètres annually, so that by the end of that time the total length was 140 kilomètres.

The year 1856 is an epoch in the sanitary progress of Paris, as it was in that year that the energetic Prefect of the Seine, Haussmann, began the realization of those grand ideas which he had conceived for the adornment and health of the capital. He had an able assistant in the person of the Director of Works, Belgrand, who prepared the plans of the aqueducts and sewers, and executed the works.

Between 1860 and 1869, on the average 35 kilomètres of sewers were constructed every year. These works are still being carried out after Belgrand's plans, according to the needs of the city and the resources available.

Most of the sewers before 1856 discharged into the Seine by the shortest route. Belgrand undertook not only to prevent the new sewers from discharging into the river, but abolished those that already did so. For this purpose the new system was organized to convey the waste waters from the small sewers into collecting sewers and thence beyond the walls.

The Main Sewers.—In accordance with the nature of the ground, the city is divided into three districts for drainage: the system of the left bank, the system of the north, and the central system of the right bank.

1. *System of the Left Bank.*—The left bank of the Seine is a tolerably flat

plain near the side of the river intersected by heights at the southern end. One of those near the city is only separated from the river by a strip of flat ground. The left bank is divided by a deep valley which forms the bed of La Bièvre, a small stream which fell into the Seine near the Jardin des Plantes. For ages La Bièvre has received all the refuse from the country through

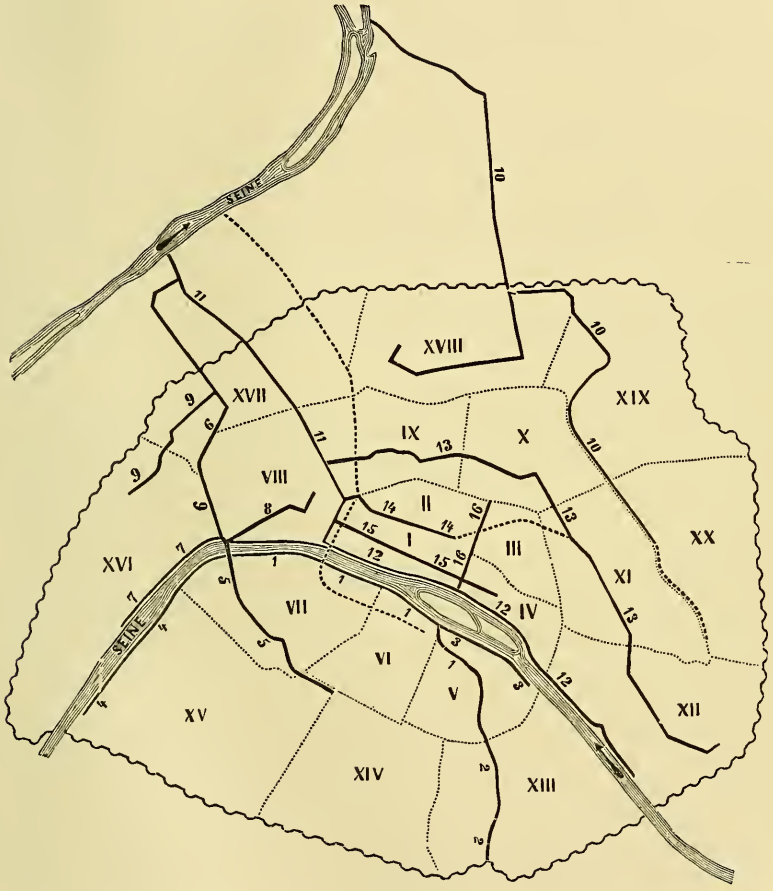


FIG. 94.—PLAN OF PARIS, SHOWING THE COURSE OF THE CHIEF COLLECTING SEWERS AND OF THE PROPOSED NEW SEWER (AFTER HUMBLOT).

Existing Sewers.
Proposed Sewers.

1. Collecting sewer of the left bank. 2. Bièvre. 3. Collecting sewer for the quays on the left bank. 4. Grenelle collecting sewer. 5. Bosquet collecting sewer. 6. Marceau collecting sewer. 7. Billy collecting sewer. 8. Montaigne collecting sewer. 9. Pereire collecting sewer. 10. Collecting sewer of the north. 11. Collecting sewer d'Asnières. 12. Collecting sewer for the quays on the right bank. 13. Collecting sewer des Coteaux. 14. Collecting sewer des Petits-Champs. 15. Collecting sewer de Rivoli. 16. Sebastopol collecting sewer.

which it passes. It has therefore become a sewer. At present it forms the point of departure for the sewer of the left bank (2, Fig. 94).

La Bièvre rises about 30 kilomètres from Paris. The quantity of water which it brings is at times so great that it is necessary to divert the overflow into the Seine near the bridge of Austerlitz. After receiving La Bièvre the sewer follows an oblique direction towards the north-west, below the river, reaching the bank near the square St. Michel. Thence it proceeds without interruption along the quay as far as the bridge of Alma. There the overflow water crosses the Seine in a syphon. This portion is called the main sewer for the left bank.

One of its branches, the sewer from the quays which begins at the eastern extremity of Paris, near the bridge of Austerlitz, runs parallel with the Seine, rejoining the main sewer near the place Saint Michel. The Grenelle collecting sewer (4) follows the quays to the west from the fortifications to the bridge of Alma, where it rejoins the chief collecting sewer (1).

The Bosquet sewer (3) starts from Montrouge, runs obliquely toward the north-west, along the avenue Bosquet, and enters the main sewer near the bridge of Alma.

The various sewers of the left bank having entered the main sewer near the bridge of Alma, the latter crosses the Seine by means of a syphon, and proceeds towards the north-west under the name of the Marceau sewers (6). At Clichy-Levallois, outside Paris, it joins the main sewer for the right bank, the Asnières sewer (11), which flows into the Seine below the bridge of Asnières.

The Marceau sewer receives the following secondary branches: the sewer for the quay Billy (7), which receives the refuse of Autueil and part of Passy; the Montaigne sewer, which carries off the overflow of the faubourg St. Honoré, etc., these secondary sewers entering the Marceau sewers close to the fortifications at Batignolles.

2. *The System of the North.*—The right bank of the Seine, which extends along a vast plain, is branched by heights exceeding the level of the plain by about 25 mètres; the heights of Montmartre and Ménilmontant are a little more elevated then the others. All the ground included between these two heights having more than 25 mètres elevation pours its overflow into the sewer of the north (10). This is composed of two arms, of which the larger receives the refuse of Ménilmontant and the smaller that of Montmartre. They unite near the gate of La Chapelle, and form a single sewer, which proceeds nearly in a right line to the north as far as Saint Denis, where it flows into the Seine below the bridge.

3. *Central System of the Right Bank.*—The greater part of the ground on the right bank is drained by the main sewer of Asnières, which is joined by the Marceau sewer near the Seine. The Asnières sewer begins at the Place de la Concorde, proceeds in a straight line towards the north-west, and leaves the city near the gate of Asnières.

This sewer has three great affluents. One, the sewer for the quay on

the right bank (12), along the river from east to west, receives the water which formerly flowed into the Seine. The longest of the affluents is the sewer for the slopes (13), which begins at the fortifications in the east, crosses all the city, following a slightly curved course, and enters the main sewer in the boulevard Malesherbes.

The sewer Petit Champs (14), and the sewer Rivoli (15), run between the two affluents above mentioned in the same direction from east to west.

The sewer Sebastopol (16) follows the boulevard of the same name from north to south, passes under the sewer Rivoli, and terminates in the sewer for the quays.

Notwithstanding these immense works, some parts of the city still empty their sewage directly into the river; but many projects exist for discharging it into the great sewers.

The water in all the sewers falls by gravitation, though the fall is exceedingly slight in some places. At Bercy only a part of the waste waters are pumped into the sewers for the quays.

Form and Design of Sewers.—The sewers of Paris are not mere drainage-pipes; they form, in fact, subterranean galleries in which workmen may move about freely.

The largest are 4·40 mètres high and 5·60 mètres wide, the smallest 0·90 mètres or 1·30 mètres in height. Their general construction is similar to those of Brussels. In the larger sewers the water runs in the middle, and there are footways on each side. In the smaller, of an oval form, there are no footways, as they are on one side only.

The sewers follow the middle of the street. There are no openings in the road itself, but in the footways, from which the sewers all extend by means of small lateral galleries.

Large dimensions have been given to these sewers because they are not merely used for the carrying away of sewage-water, but they afford room for drinking-water pipes, telegraphic and telephonic wires, pneumatic tubes intended for the despatch of messages, and for the distribution of force to pneumatic clocks in dwellings, etc. Gas-pipes are not placed in the sewers because of the danger of explosion.

It cannot be denied that this arrangement has great advantages. Thus, the water-pipes can be easily examined, and any defect repaired. The ground on which Paris is built is in great part undermined by catacombs, ancient quarries which supplied the stone for the old buildings of the city. If the water-pipes were laid in such ground, any leaks might occasion serious accidents.

With these sewers there is no need to take up the pavement when pipes need repair, etc.; there are no telegraphic posts, with aërial wires, the continual humming of which is so unpleasant. Moreover, the sewers of Paris are of more varied service in the removal of refuse than those of other countries. They carry off all the refuse of the streets as well as the waste waters from houses and factories, etc.

By this arrangement the streets of Paris can always be kept perfectly

clean, and the watering and sweeping occasion scarcely any inconvenience, as everything immediately disappears into the sewers through the numerous openings placed in the footways.

The passage from the footway to the sewer is so constructed, and has so great a fall, that no stoppage is possible; and thus the cleansing is accomplished without difficulty (Fig. 95). The sewers are also ventilated by means of these openings.

It is evident that this system greatly increases the difficulty of maintaining cleanliness in the sewers themselves. But the Parisian troubles himself very little about this, not comprehending how any one could hesitate between dirty sewers and untidy streets if the alternative were placed before him.

Sewers from a Sanitary Standpoint.—From the sanitary point of view, the following question is more important than any other: What is the system most likely perfectly to secure a city against the pernicious effects of sewage, the ordinary system by which the refuse of the public roads does not enter the sewers, or the Parisian system, in which everything enters them?

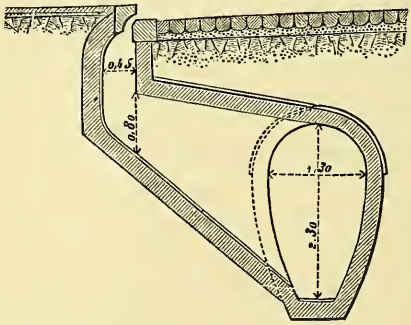


FIG. 95.—OPENING INTO SEWER.

The answer depends on the following circumstances:—

1. The nature of the substances removed from the streets in scavenging.

2. The possibility of keeping the covered sewers free from deposits, and of avoiding putrefaction and the evolution of gases.

3. The difficulty experienced in rendering innocuous the solid substances carried into the sewers.

4. The greater or less risk incurred by the workmen employed in the sewers.

The rubbish of the streets is chiefly composed of sand from the macadamized roads or that spread on the ground, droppings of horses, and other manure in less quantity. These do not seem to be of a nature to endanger the public health if care be taken to remove them in carts, as is commonly done.

When taken to a suitable place, the sand mixed with droppings and other rubbish need not become a nuisance. Besides, nothing is easier

than to render it innocuous by submitting it to the action of fire ; after which it may even be used for various purposes.

Per contra, sand is a source of danger when introduced into the sewers. It presents in fact a serious obstacle to the free flow of the water and causes deposits, which, according to the experiments made in Paris, cannot be altogether avoided, however great the care taken to keep the sewers clean.

The grains of sand become mixed with organic matter, forming an offensive and greasy mass.

It is clear that if it is required to remove from the sewers such infected material, depositing it in any place is a much more serious matter from a sanitary standpoint than the deposit of rubbish which has not been in the sewers.

Concerning the fourth point, the following tables, given by Humblot, are the only ones known :—

TABLE OF AMOUNT OF SICKNESS.

Years.	Number of Workmen.	Small-pox total.	Small-pox per 1,000 Workmen.	Typhoid fever total.	Typhoid fever per 1,000 workmen.	Cholera total.	Cholera per 1,000 Workmen.
1882	850	2	2·35	7	8·24	—	—
1883	850	—	—	12	14·11	—	—
1884	850	—	—	7	8·24	3	3·53
1885	850	1	1·18	2	2·35	—	—

TABLE OF DEATHS.

Years.	Number of Workmen.	Lung diseases.	Deaths from lung diseases per 1,000.	Typhoid fever.	Deaths from typhoid fever per 1,000.	Cholera.	Deaths from cholera per 1,000.	Various diseases.	Deaths from various diseases per 1,000.	Total deaths.	Total deaths per 1,000.
1882	850	8	9·41	—	—	—	—	2	2·35	10	11·77
1883	850	5	5·88	2	2·35	—	—	—	—	7	8·24
1884	850	5	5·88	1	1·18	1	1·18	1	1·18	8	9·41
1885	850	7	8·24	1	1·18	—	—	7	8·24	15	17·65
Mean	850	6·25	7·35	1	1·5	0·25	0·29	2·50	2·94	10	11·77

It will be seen that positive conclusions cannot be drawn from the above tables. The duration of the observations is too short ; the other conditions of life of the workmen are ignored ; the table of mortality does not state whether the pulmonary affections were acute or chronic, and if the latter, what was the constitution of the deceased. There is no indication of the age of the workmen in the sewers, the number of hours they work, the length of time they have been employed in this kind of work. Neither is it stated whether the passages are well ventilated, or the reverse, etc. All these points need to be taken into consideration. However, the figures do show a mortality from typhoid fever twice as great as that for all Paris, so

that we are justified in concluding that the air and absence of light in the sewers depress the normal functions of the human organism; therefore working hours in the sewers should be as short as possible. The general conclusion appears to be that the Parisian system of allowing road-scrapings to enter the sewers is objectionable from a sanitary standpoint.

Fall and Cleansing of Sewers.—In order to prevent, as far as possible, any deposit in the sewers, the fall should be increased as the mass of water becomes less considerable.

Apart from this, the fall will vary with the slope of the ground, and the quantity of solid substances discharged by the sewers; but it must never be too great or unequal.

In Paris the principal sewers have usually a fall of from 0·26 to 0·30 mètres to the kilomètre. In the secondary ones it is from 0·30 to 1·50 mètres. This inclination gives a swiftness of current from 0·25 to 0·45 mètres a second in the large sewers, and from 0·30 to 0·90 mètres in the others. In common sewers the fall varies greatly according to the conformation of the ground; it is from 1 to 7 mètres to the kilomètre. So great a variation in the falls has a tendency to encourage deposits, especially as solid substances and sand from the streets are admitted. The cleansing then becomes as laborious as costly. 850 men are employed in this work in Paris.

In the principal sewers the velocity of the current varies from 0·25 to 0.90 mètres a second; experience has shown that when it is below 0·30 mètres deposits of mud are formed, and deposits of sand when it is less than a mètre.

On this account the sewers need continual cleansing in order that the sewage may flow freely. Boats with paddles are used for this purpose in the great sewers, and waggons with paddles in the smaller ones.

In the former the paddle is placed at one end, and is lowered by means of a screw, so as to bar the passage of the water. The waggons run on rails placed on the footways on each side of the sewer. The same system is employed in Brussels, but the boats and waggons in Paris are larger, more complicated, and more strongly made than those represented in Fig. 83. The smaller waggons in Paris are called waggonettes.

The quantity of sand set in motion by the draining of the sewage by means of a paddle boat may be as much as 200 cubic mètres; for a waggon with paddles it is about 50 cubic mètres, and 10 cubic mètres for a waggonette. As the sand is being removed, the boat or waggon proceeds, but to ensure this removal, the water behind the paddle should be at least from 0·20 to 0·40 mètres high. If the quantity of water is deficient or the deposit excessive, the apparatus does not effect its purpose. It has, therefore, been necessary to adopt other measures for removing part of the sand from the sewers. For this purpose depressions are made in the sewer, in which the sand is deposited.

These basins are in pairs along the bottom of the sewer. They are emptied alternately by closing the passage of sewage over the one in question.

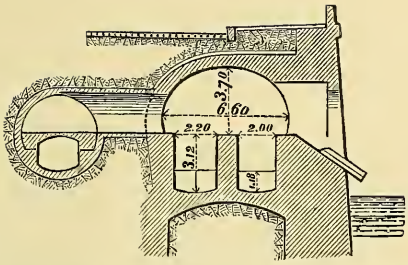


FIG. 96.—BASINS FOR DEPOSIT OF SAND IN SEWERS.

The removal of this offensive sand is attended with so many difficulties, that it has been necessary to build the reservoirs near the Seine or the St. Martin Canal, thus facilitating the emptying of their contents on to the boats. When they are a little way off the quays, the sand is first put in waggons, and pushed on rails to the place of embarkation.

There are passages between the Billy sewers and the Seine, and between the sewers for the north and the St. Martin Canal, in which the waggons used for carrying away the sand can move. These sewers have no reservoirs. The sand is collected from the bottom of the cuvette when the flow of refuse-water is small. The water is kept back for some hours, and the sand loaded on the waggons in question.

The quantity of sand collected by the reservoirs alone reaches the enormous figure of 10,000 cubic mètres every year. Some idea may thus be formed of the quantity of sand which passes into the sewers.

Similar basins for the collecting of sand have been constructed in the left bank of the Seine, near the bridge of Alma, in order to prevent sand from entering the syphons, by which the sewage is carried to the other bank. They render great service in diminishing the amount of sand in the sewer Marceau. Obstruction in the syphon is prevented in a very ingenious manner by means of a wooden ball, which is made to move regularly from one side to the other. This ball, arrested in its progress by the sand, retains the water, and sets up a current so rapid between itself and the bottom of the syphon, that the sand is carried away by the water as fast as the ball advances (Fig. 97).[1]

In sewers of the second and third orders, where the quantity of water is less, sluices have been placed in certain places, by which the water is held back until it accumulates, and being then released, the sewer is effectually flushed.

There are 350 of these. Some of them can hold back 100 cubic mètres of water.

This plan has inconveniences, for, as the water escapes, mud becomes attached to the upper side of the sewers. Automatic flushing cisterns have

[1] The works at Clichy, near Gennevilliers, where the sewage is used for purposes of irrigation, possess extremely interesting and instructive models of the Paris system of sewers.

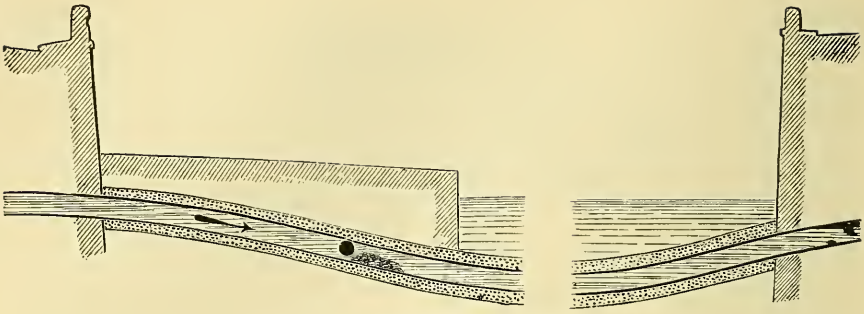


FIG. 97.—THE ALMA SYPHON.

therefore been added for cleansing purposes, which are fed by a small stream of water.

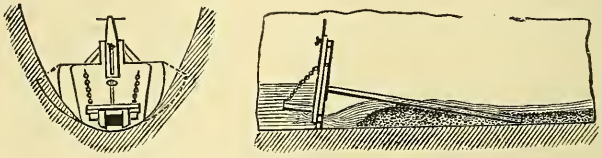


FIG. 98.—MITRAILLEUSE À MAIN.

Portable cleansers are used for removing the sand from sewers where there is a sufficient flow of water (it must not be less than 60 litres a second). They are called "mitrailleuses à main" (Fig. 98). When the mass of water is less, the "brouette mitrailleuse" is employed.

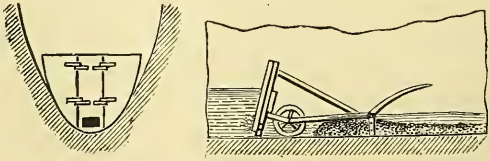


FIG. 99.—BROUETTE MITRAILLEUSE.

These machines move with a velocity of about 60 mètres an hour.

When the mass of water in the sewers is not sufficient to carry away the sand, a scraper must be employed, worked by the hand. If the distance is not too great, the workmen can drag the sand to the main sewer in this way. Otherwise it is raised in buckets to the street, from which it is removed in carts (Fig. 93) to the places of embarkation on the Seine and the St. Martin Canal. Sheet-iron gullies are placed at the openings of sewers in the most frequented streets, which are paved or macadamized, to intercept sand and gravel. These are afterwards emptied, and their contents removed in carts.

The principal sewers are cleared from all solid refuse in ordinary circumstances by means of paddle-boats and waggons. In smaller sewers different methods must be employed for removing the deposits. Engineers

put the solid refuse of the sewers into three classes: (1) Mud composed of all sorts of small particles. (2) Refuse litter, consisting of bits of straw and vegetable substances. (3) Sand formed from mineral detritus having a density double that of water. The methods employed for the removal of the sand have been described.

When the mud is unmixed, it may be easily removed by flushing with water, or by a shovel, if water is not obtainable. If the mud is mixed with litter or sand, it is agitated in order to effect a separation.

From some sewers, however, the mud cannot be got rid of without difficulty. This happens in sewers which have too small a fall, and are connected at an improper level with larger sewers, thus causing a retarded flow in the affluents. Flushing with water and the use of the scraper have no effect. The mud must then be cleared away, after the water between two sluice-gates has been allowed to escape. The radical remedy for this condition is to construct the sewers with proper inclinations. The mud and sand are always more or less mixed with litter, which easily forms water-tight dams, requiring strong jets of water for their removal.

Sewers near the markets are provided with baskets for refuse, made of sheet-iron pierced with holes, placed under the openings into the sewers. The refuse is received into these, and remains there while the sand, mud, and water escape. These baskets, containing from 210 to 240 litres, are drawn up by means of a crane, and emptied into carts, which carry away their contents.

It will be easily understood that the friction of such enormous masses of sand necessitates frequent repairs of the sewers. In some cases the deposits cause complete obstructions, the sewage overflowing into the

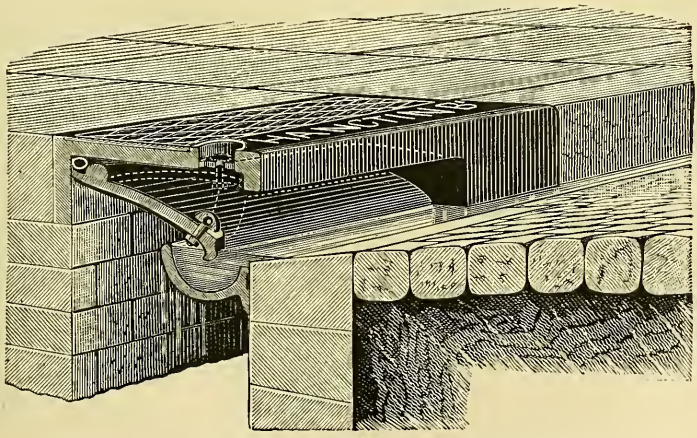


FIG. 100.—OPENING OF THE HANCTIN SEWER.

The valve, of which the inside edge is immersed in water, forms a movable trap. When raised, it can be kept in position by means of a hook fixed in a hollow of the iron plate above.

streets. The same thing occurs occasionally during storms of rain. It is intended to remedy this by constructing several new sewers, the outline of which is indicated in dotted lines on Fig. 94.

The deposits in the sewers are not removed so frequently as is desirable, the result being that they become decomposed, and give off fetid gases, the presence of which is betrayed at the street grids.

For some time it was believed that this inconvenience might be obviated by closing the openings in the footway by means of movable valves.

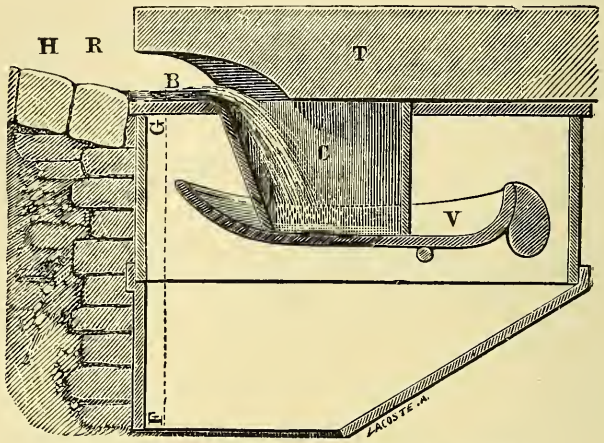


FIG. 101.—OPENING OF SEWER (ROGIER-MOTHES).

T. Footway. R. Channel. B. Entrance to the sewer. H. Roadway. C. Tank receiving water from the road. V. Movable valve opening when the tank C is full.

Figs. 100 and 101 show gullies constructed, one by the firm of Hanctin, the other by the firm of Rogier & Mothes. These apparatus, in the absence of other ventilating openings to the sewer, produced an effect which was contrary to what was expected of them. The sewers being unventilated, foul sewer-gases accumulated to such a degree as to enter the houses; work in the sewers became extremely dangerous, and when the mouths of the sewers were opened, the bad odour was almost insupportable.

The experiments made in Paris fully demonstrate that if sewers are to be prevented from diffusing bad smells, they must be kept free from deposits, carefully ventilated, and cleansed.

It has been proposed to close the openings in the streets, and employ ventilating shafts for the removal of sewer-gases. But it is well-known that such appliances only act on a small length of sewer, besides being complicated and difficult to manage.

Ventilation is most effectually secured by making numerous openings of sufficient size. If then it is desired to place traps in the openings to the sewers from the pavement, the openings for ventilation must be placed in the road over the sewers.

In England it has been proposed to ventilate the sewers by means of shafts opening above at the gas-burners of the public lamps in the streets. This has not been found advisable, as when the gas is not burning, the exit of foul gases at such a low level might produce serious nuisance.

Drainage of Houses. Private Drains (*Decrees of March 26th*, 1852. *Orders of Dec. 19th*, 1854; *May 4th*, 1860; *April 24th*, 1866; *February 14th*, 1872; *July 2nd*, 1879; *October 28th*, 1881).—All houses situated in a street where there is a sewer must have direct connection with it, so as to allow of the removal of waste-water and rain-water. These private drains are constructed at the cost of the owners. They are built of masonry having a height of at least 1·80 mètre, and a width of 0·90 mètre. For small houses in streets little frequented, the use of pipes made of cast-iron or glazed earthenware is permitted. They must be at least 0·30 mètre in diameter, and have a fall of 0·073 mètre.

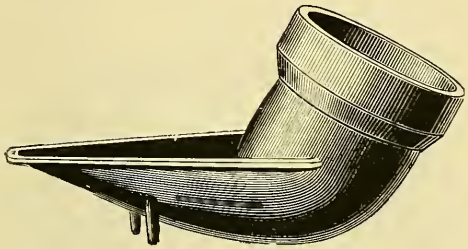


FIG. 102.—SYPHON TRAP OF CHADAPAUX.

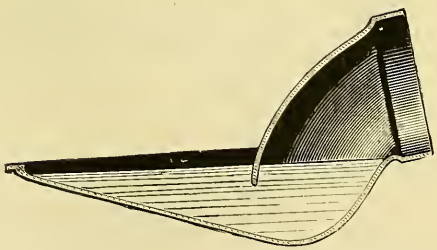


FIG. 103.—SECTION THROUGH THE SAME.

The private drains also contain the pipes for the distribution of drinking water.

The private drain ends at the outside wall of the house; the pipe for the discharge of waste water passes under the wall. In the old arrangements it terminates in a trap, one form of which, made by Mr. Noel Chadapaux, is represented in Figs. 102 and 103.[1] The more recent apparatus will be shown at page 315.

The plans for private sewers are prepared by the engineers for water and sewers at the cost of the administration. The owner has the right to have the work executed by a contractor of his own choice, always pro-

[1] The use of these is now forbidden, because of their defective and uncertain closure.

viding that he is accepted by the department charged with the oversight of works. If the owner neglect to have the work executed, the department proceeds with it at his expense. Payment is made directly by the owner to the contractor, but he has the right to require an audit of the account by the official engineer.

The owners must arrange for the cleansing of the private sewers at their own cost; but the work can only be executed by persons authorized by the department. If the owner prefers, the department will undertake the cleansing at a fixed rent.

Regulations as to the Waste-Pipes of Houses (*Prefectoral Orders of November 10th, 1886, and November 20th, 1887*).—In these orders are also found the regulations in force for the system of water-closets in use in Paris. We mention them in this connection, the arrangements for privies being described farther on.

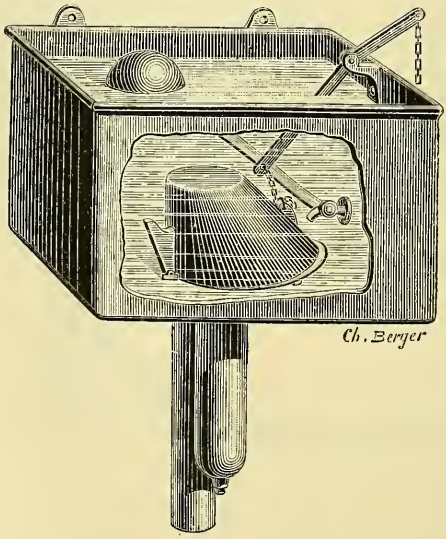


Fig. 104.—Flushing Cistern by N. Chadapaux.

By the terms of the minutes of November 10th, 1886, the rain and waste-water may be carried to the public sewers, also the night-soil, if the house is situated near a sewer of the first or second class, or near a sewer provided with the apparatus for flushing. A fixed rent is charged.

In addition, the house must possess a service of water, and a drain leading into the public sewer. By virtue of the regulation of November 20th, 1887, houses situated in streets where there is a sewer may pour their night-soil into it on condition that the separating system is applied, and that the construction of the discharge-pipe and separating apparatus has been approved by the department.

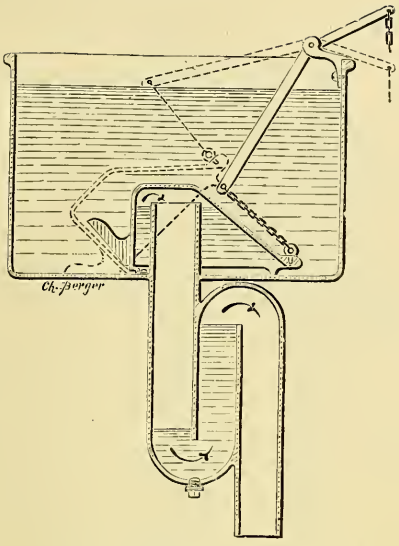


Fig. 105.—Section of the Same.

This apparatus must be placed in a well-ventilated vault, the ground of which must be impervious to moisture, and hollowed into the cuvette form.

The following arrangements are common to both orders :—

All water-closets must be provided with flushing-cisterns, or some other apparatus supplied with water from the service, at the rate of at least 10 litres a day for each person.

The flush of water should have sufficient force to clean the cuvettes.

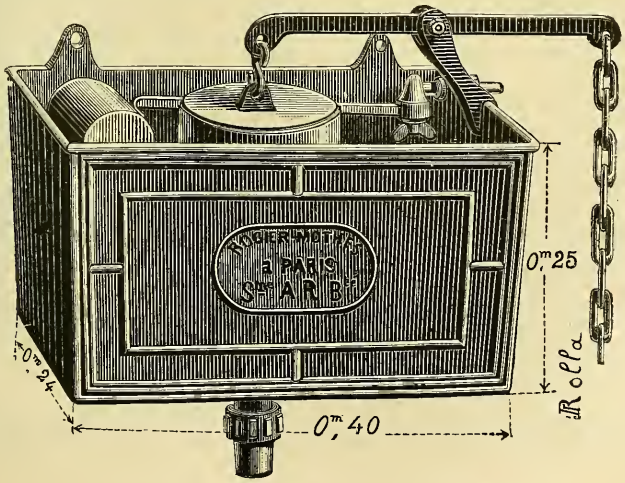


Fig. 106.—Flushing Cistern (Rogier & Mothes).

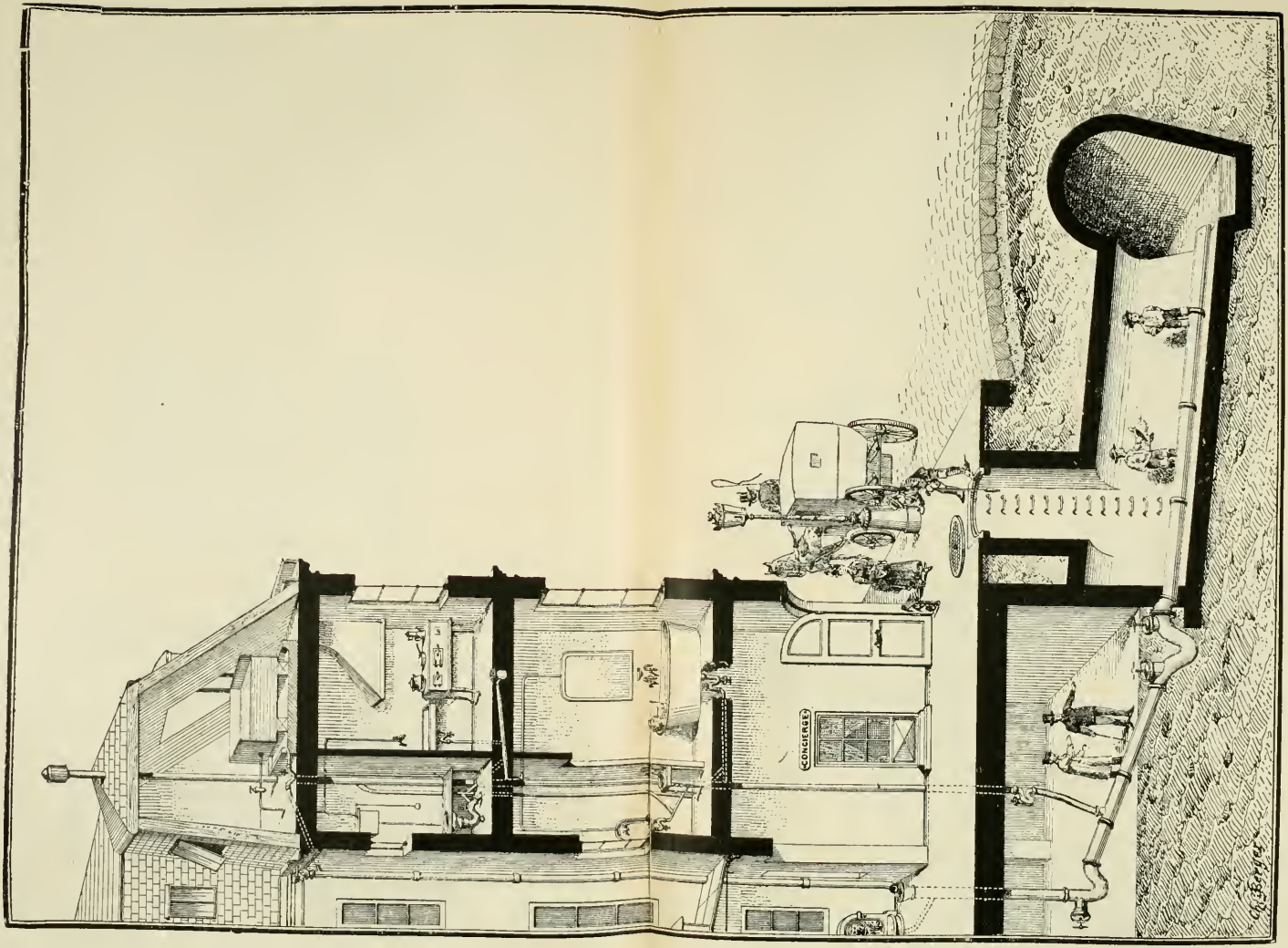


FIG. 107.

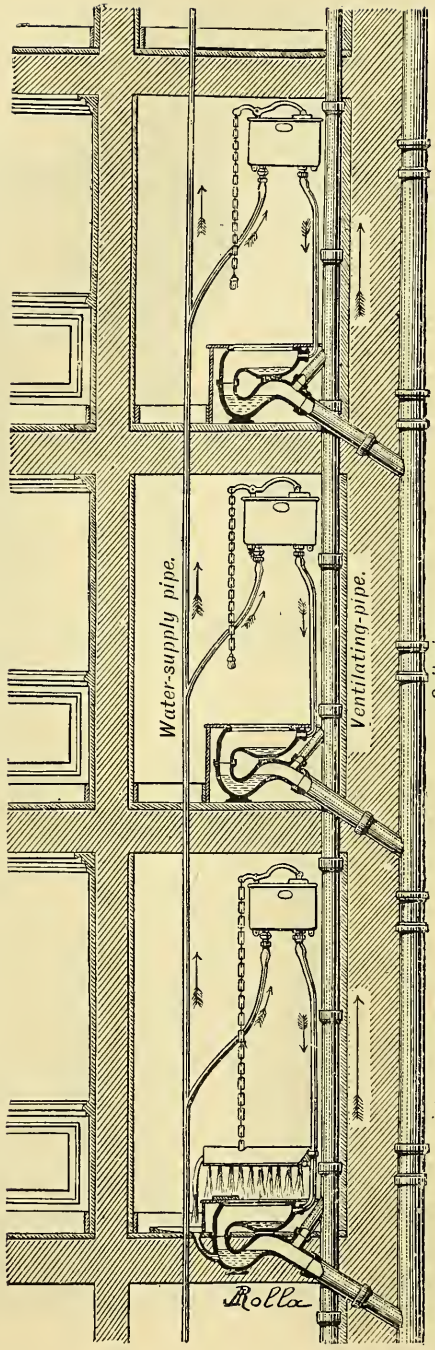


FIG. 108.—ARRANGEMENTS FOR WATER-CLOSETS IN A PARISIAN HOUSE (ROGIER & MOTHES' PLAN).

This apparatus and arrangement must be approved before being put into position, and examined by the department before use.

Figs. 104, 105, and 106 represent flushing-cisterns approved by the Administration. The two first are constructed by M. Noel Chadapaux, and the other by MM. Rogier & Mothes. The self-acting cisterns, in which a floating stop-cock is used, are on the same system as the English cisterns, but more complicated.

All water-closets must be furnished with a permanent water-seal.

Apparatus of this kind may also be employed in public latrines, workshops, warehouses, and other places frequented by many persons.

FIG. 109.—LEAD TRAPS (POCOCK'S PLAN).

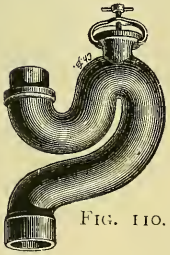


FIG. 110.

All pipes for waste-water must have a syphon trap under the sink.

The lead discharging pipes commonly used in England have been adopted in France.

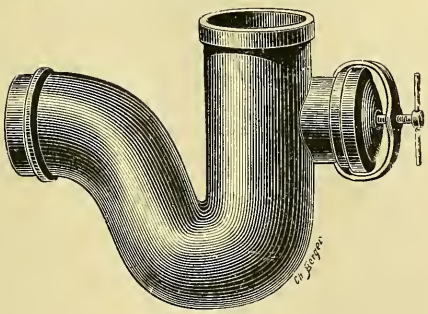


FIG. 111.

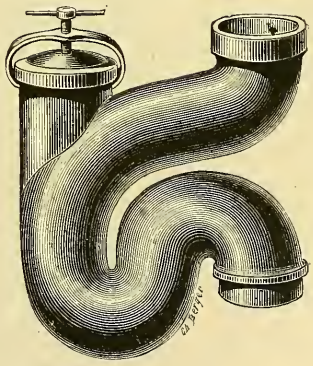


FIG. 112.

SYPHON TRAP FOR VERTICAL FALL PIPES.

The syphons represented in Figs. 110, 111, and 112 are of purely French invention (Noel Chadapaux's system), and are furnished with an opening for inspection. The pipes for carrying off rain-water must be kept from all direct communication with the drains, and air must circulate in the pipes.

The rain-water in the yards flows into surface-traps, which prevent the sewer-air from escaping into the yards. They serve also to intercept communication between the spouts and the sewers.

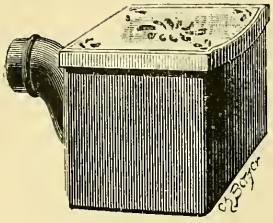


FIG. 113.
TRAP (N. CHADAPAUX).

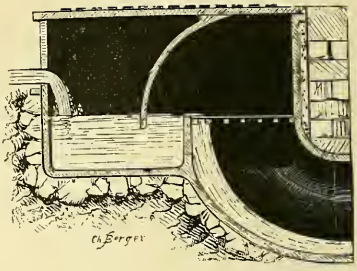
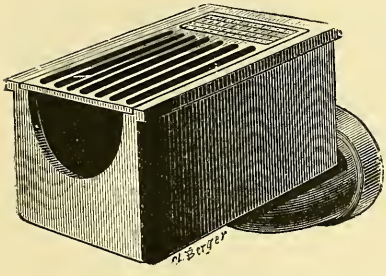


FIG. 114.
SECTION OF THE SAME.



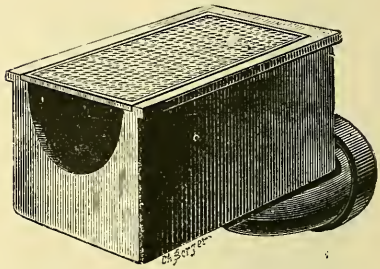


FIG. 115.—OTHER TRAPS (N. CHADAPAUX).

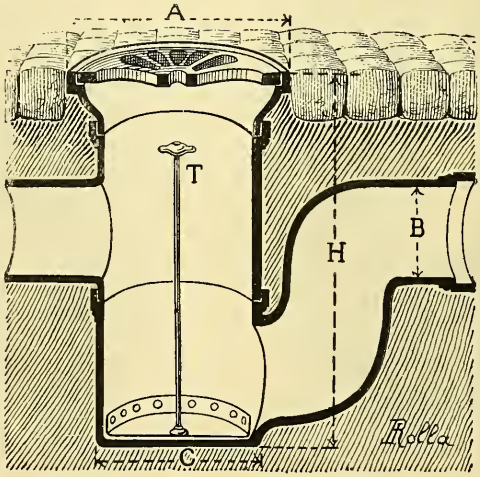


FIG. 116.—ROGIER-MOTHES' TRAP.
A. Grating in the yard. T. Shaft for raising the box C, which retains the solid substances. B. Outlet pipes to drain.

Pipes for night-soil, waste-water, and rain-water, must have a minimum diameter of 0.08 mètre to a maximum of 0.16 mètre.

The discharge-pipes of water-closets must not form a greater angle with the vertical than 45 degrees.

Each discharge-pipe must be continued upwards to the top of the roof as far as the ridge, and must have a free extremity (p. 313). The solid refuse of kitchens, etc., must not be thrown into the waste-pipes or other conduits.

The drain-pipes at the bottom of waste-pipes must be connected with the sewers (Fig. 107). They must be in a straight line; at every change of direction or fall there must be an opening for inspection easily accessible.

The drainage-pipes must have a minimum fall of 0·03 mètre per mitre. In cases where this is impossible the department may authorise a smaller fall on condition that flushing cisterns are employed, or some similar arrangement made.

The diameter of drainage-pipes is determined by the fall, and the quantity of water to be discharged. In no case must it be less than 0·16 mètre.

Every pipe for drainage at its exit from the house must be provided with a water-trap in the syphon form, having a dip of at least 0·07 mètre, that all communication between the interior pipes and the public sewer may be prevented.

Each of these syphons must have an opening for inspection at the upper part, and must be approved by the department.

Drainage-pipes may be made of glazed earthenware or some similar material. The joints must be water-tight and without any internal projections.

The use of cast-iron pipes is also allowed when requested.

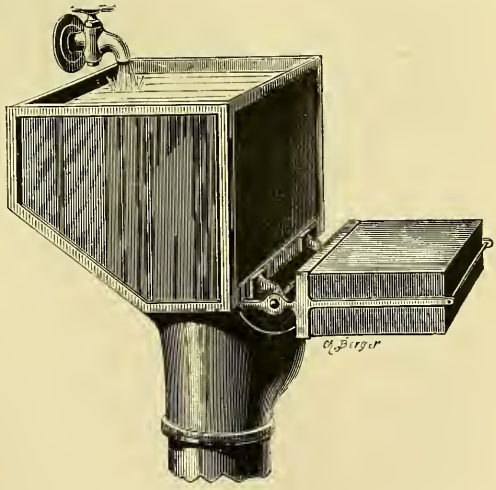


Fig. 117.—Automatic Flushing Cistern for Drainage-Pipes (N. Chadapaux).

Fig. 117 shows a flushing apparatus applicable to such cases. The square box to the right of the cistern shows the outside part of a valve which forms the bottom of the cistern. In this box is an iron ball; the

whole weighs a little less than the quantity of water contained in the cistern. When the latter is full, the bottom gives way and the box is emptied, the ball rolling to the bottom. The valve remains open until all the water has escaped. Then the weight of the box and of the ball shuts the valve.

When there are water-closets in houses, the cesspools must be filled up, or converted into vaults.

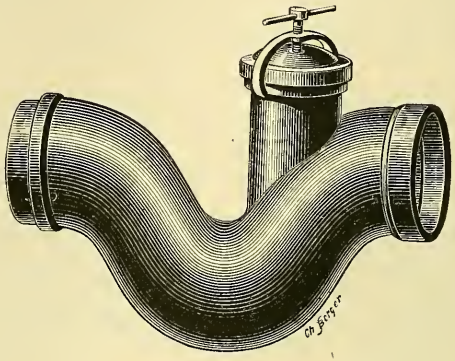


FIG. 118.—SYPHON (N. CHADAPAUX).

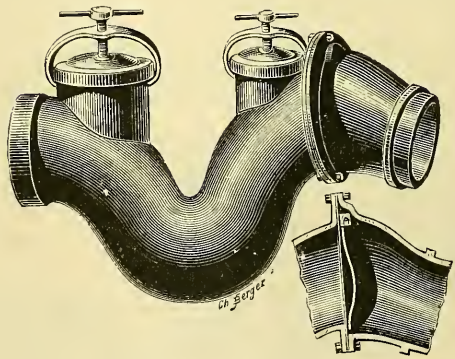


FIG. 119.—SYPHON (N. CHADAPAUX).

Figures 118 and 119 represent horizontal syphons in the system of N. Chadapaux approved by the department. Fig. 119 shows in addition a glass valve fixed to a piece of india-rubber. This is to prevent sewer-gas from entering forcibly by the syphon when the water rises.

All the works mentioned above must be executed under the oversight and control of the department, which is also charged with their inspection.

Privies.—The system of closets in use in Paris leaves much to be desired from the hygienic standpoint. If in this respect Paris is inferior to other less important cities, it is chiefly because the public health is abandoned to the care of the police.

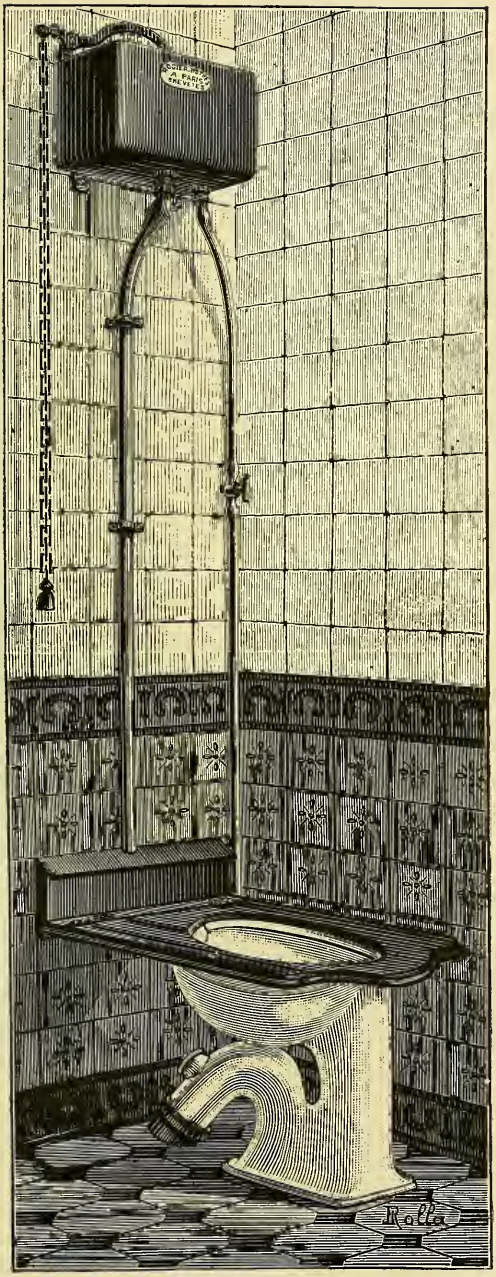


FIG. 120.—WATER-CLOSET (ROGIER-MOTHES).

The time is past when it could be supposed that good sense and administrative capacity suffice for the proper regulation of the public health. It has never been doubted that special technical knowledge is necessary for efficient direction of other branches of the administration, and this is equally true in relation to the care of the public health, as statistics conclusively prove.

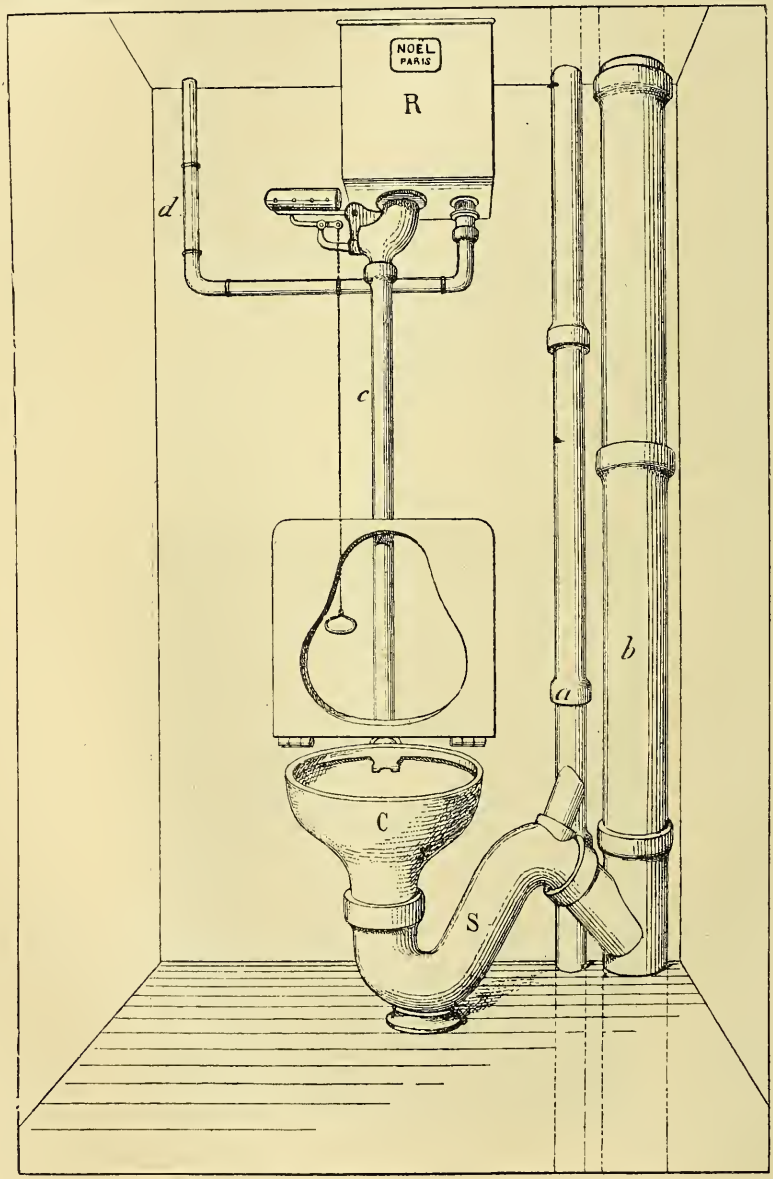


FIG. 121.—WATER-CLOSET (N. CHADAPAUX).

Sanitary improvements in Paris have not produced the same results as in other cities in diminishing the general mortality and the deaths from typhoid fever (see the last chapter).

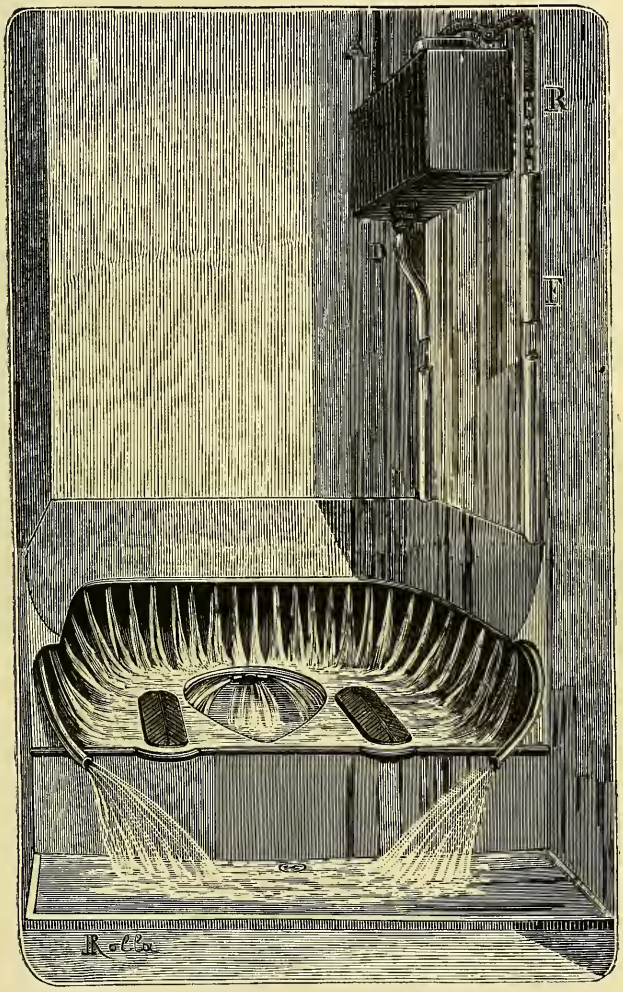


Fig. 122.—Water Closet à la Turque.

Water-Closets.—Water-closets of some kind were introduced into Paris by a regulation of the 2nd July, 1867, issued by the celebrated Haussman, which was replaced by one in 1887.

It contains provisions relating to the employment of the separating apparatus or filtering-tubs which hadbeen used in certain cases. These tubs are composed of a metallic cylinder, pierced with holes and enclosed

in an outer case. The solid substances are retained in the cylinder; the liquid flows into the outer case and thence into the sewers.

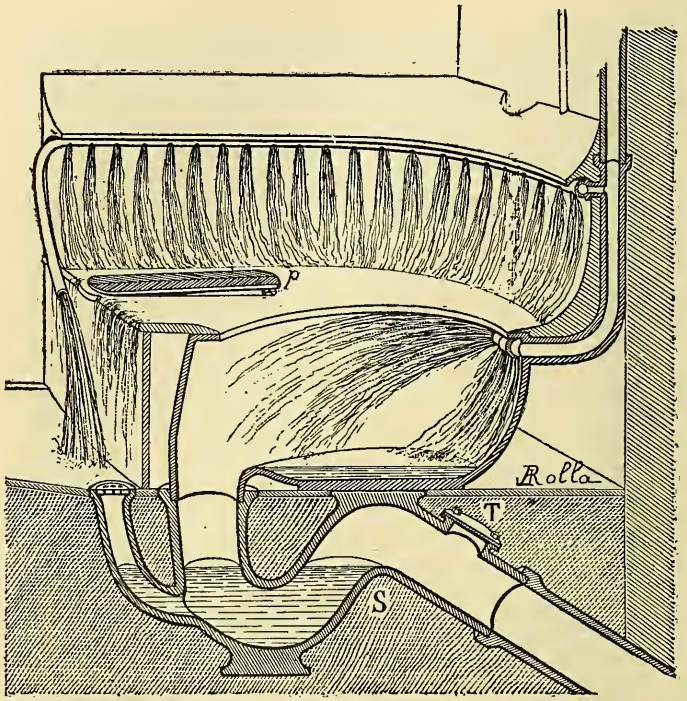


Fig. 123.—Section of a Water-Closet à la Turque.

However it happens that when the cylinder is changed hardly anything is found but pieces of paper. It is therefore an error to suppose that solid pieces can be prevented from entering the sewers by this means.

Of the water-closets now in use some are of the English type, as may be seen in Figs. 120 and 121. In form and construction these are, however, inferior to the English water-closets (see pp. 123 to 128).

On the contrary, water-closets of purely French construction present types which are quite original.

By a strange contradiction the most civilized nation obstinately adheres to the most primitive method of defæcation: it is generally made in the crouching position, *à la turque*, as they say. The new French water-closets are arranged in the manner represented in Figs. 122 and 123.

With such a construction it is hardly possible to maintain the necessary clean lines; the 10 litres of water allowed are not sufficient for adequate flushing, as shown in Figs. 122 and 123.

Fig. 124 shows a form of closet in use in schools, factories, barracks, etc. The flushing is automatic.

The Removal of Night-Soil.—Berlier's System.—The fear of introducing night-soil into the sewers of Paris has caused attempts to be made for the discharge of the fæces by means of separate pipes, placed in the galleries of the great public sewers. A partial application of this plan has been made in places where there is a network of sewers, the fall of which is insufficient.

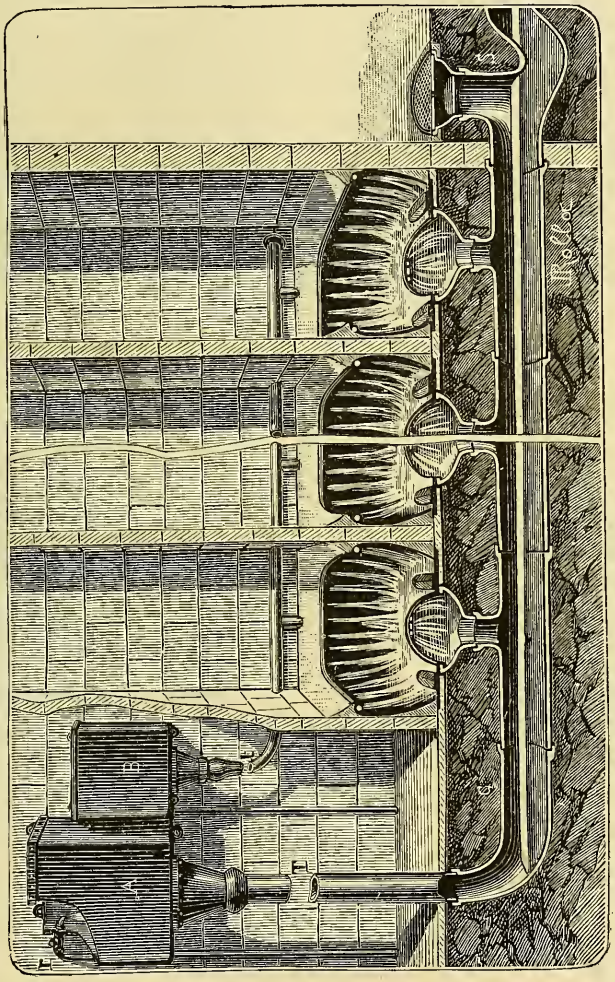


FIG. 124.—SET OF SEATS OF WATER CLOSET (ROGIER-MOTHES).

In the pneumatic systems of Lierneur in Holland, and Berlier in France, the fæces are aspirated from the pipes by means of suction-pumps, and then conveyed to a depôt. In this they are converted into powder and ammoniacal salts.

They can also be discharged on to sewage farms in their natural state by means of driving-pumps. In Lierneur's system one reservoir serves for

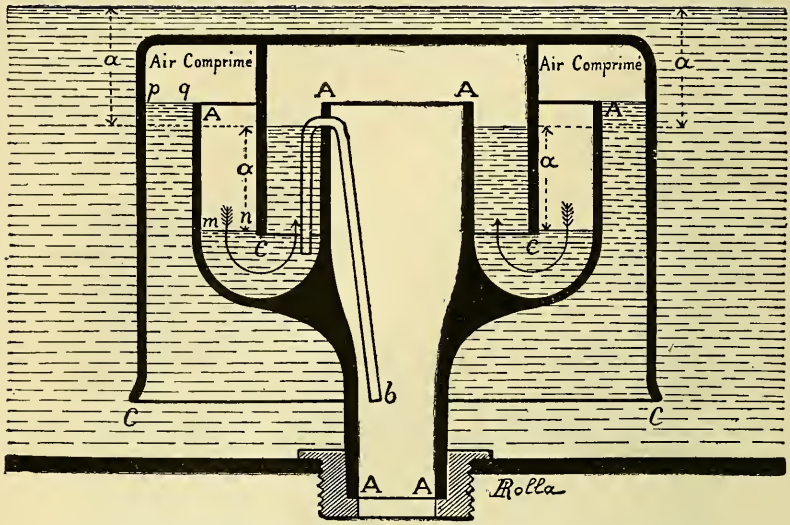


FIG. 125.—AUTOMATIC FLUSHING CISTERN (ROGIER-MOTHES).
Used for water-closets. In Fig. 124 it is seen at A and B.

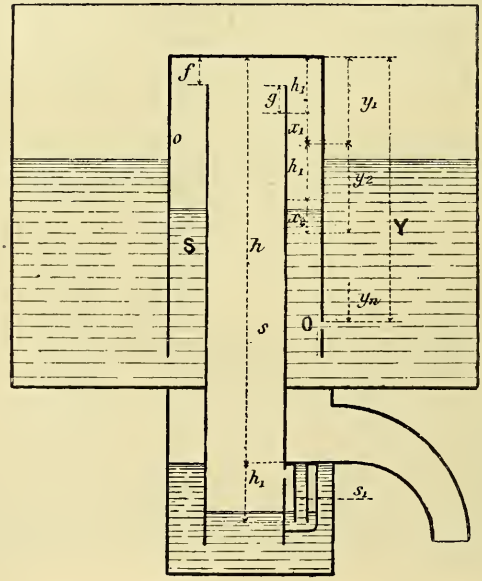


FIG. 126.—AUTOMATIC FLUSHING CISTERN (GENESTE HERSCHER).

several houses; in Berlier's, every house has a discharge-pipe opening into a separate reservoir connected with the general drainage.

The Berlier system has been in use since 1883–1884 in the barracks of La Pépinière, and in three hundred private houses of the 8th and 9th arrondissements. It is arranged in the following way :—

A double apparatus in iron, hermetically closed (Figs. 127 and 128) is placed in the cellar.[1]

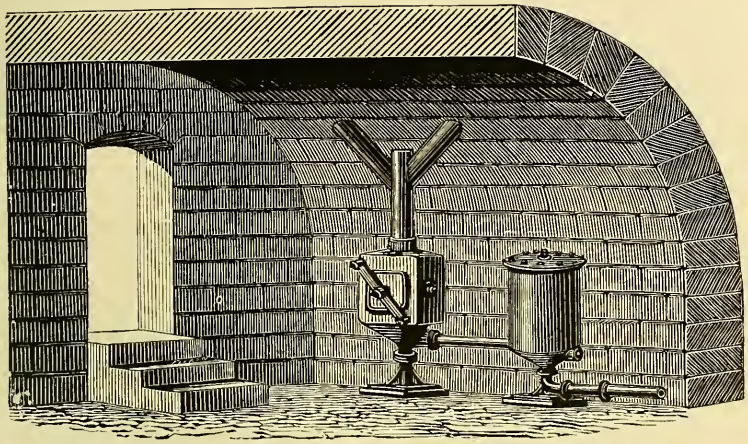


FIG. 127.—ARRANGEMENT OF THE BERLIER APPARATUS IN A CELLAR.

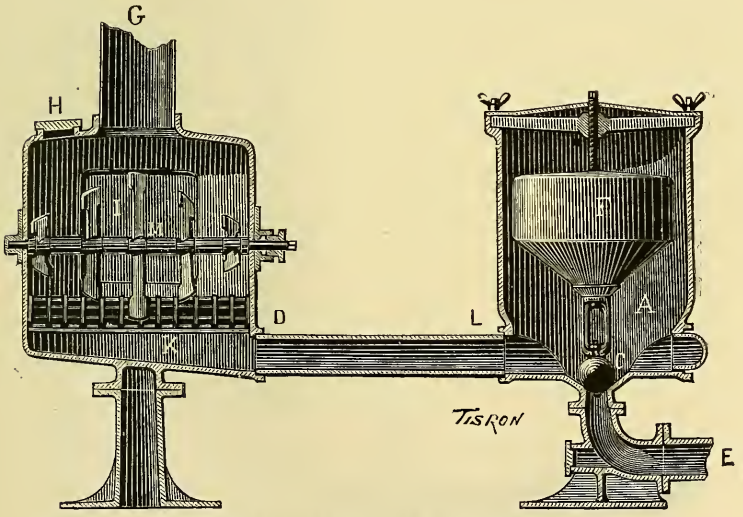


FIG. 128.—BERLIER'S APPARATUS (SECTION).

The receiving apparatus communicates directly with the discharge-pipe G of the water-closets; the grating K prevents large and solid substances from entering the drain. Their presence is ascertained by a workman, who turns the palette M. Solid matters are removed by the door, which can be seen (Fig. 127).

[1] All the cellars are so arranged that reservoirs for latrines can be placed in them (fosses mobiles, tinettes filtrantes, etc.).

Everything passing over the grating arrives at the evacuator by the pipe DL. This consists of a cylinder A, at the bottom of which is a discharge pipe E communicating with the drain. This pipe is closed by means of a valve formed of a ball C fixed to a float F, which is raised by the sewage so that the valve C is opened, and the contents allowed to pass. Immediately afterwards the valve closes, and all communication between the pipes in the house and the public sewer is cut off. The public drainage is effected by iron tubes from 0·12 mètre to 0·15 mètre in diameter

FIG. 129.—ORDINARY ARRANGEMENT OF A PRIVY WITH THE VENTILATOR (MONTUPET).

placed in the public sewers. The aspirated night-soil is conveyed to the works of Levallois-Perret.

Privies.—Privies are still used in the greater number of houses in Paris.

It is true that great pains are constantly taken to reduce the disadvantages to a minimum. Nevertheless, the system as a whole presents difficulties so serious that the most ingenious improvements are powerless to remedy them. Fig. 129 shows an improved arrangement for privies. The discharge-pipe common to the privies on all the floors of the house is continued to the top of the roof, and terminates in a ventilator.

The privy is in masonry, cemented. The night-soil goes into an air-tight cast-iron tub. The fæces are aspirated from this by a pump, a pipe connecting this with the apparatus for removal.

As the pump aspirates the air from the barrel the contents of the privy are raised up this pipe, and are sucked into the barrel. The fetid gases which escape during the operation are conducted to a small stove and burnt there.

Movable privies are also used; that is to say, tubs placed in the cellar under the discharge-pipe. This arrangement has been found so unworkable that it is proposed to forbid its use. It is impossible to foresee when the tubs will be full, and in the houses of the working classes great inconveniences have resulted. For this reason they were in 1867 replaced by the filtering-tubs previously described. The public were requested to throw their waste water into the latrines; the discharge-pipe was thus cleansed, and the contents of the tubs diluted. It was subsequently ordered that privies should be provided with a water-pipe and tap. Such an arrangement does not provide a flush of water equal to that in water-

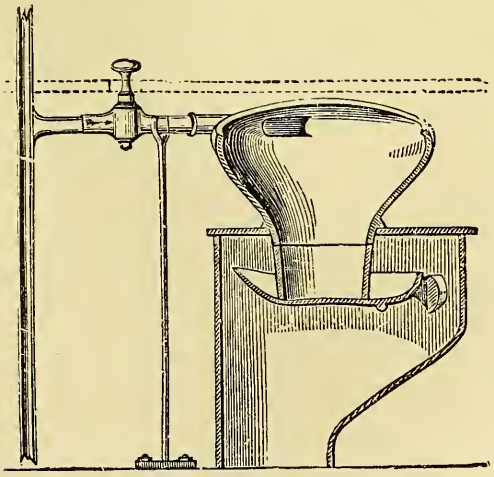


FIG. 130.—PRIVY (ROGIER-MOTHES) THE VALVE OF WHICH OPENS AND SHUTS AUTOMATICALLY.

closets, but it makes the cleansing of the cuvette itself possible. This is done by a broom like a great painter's brush. In consequence of a more recent police regulation, the bottom of the cuvettes of privies has been furnished with a valve (Fig. 130).

It is only in great houses and hotels that seats are found in water-closets etc. The great mass of the people prefer the position à la Turque.

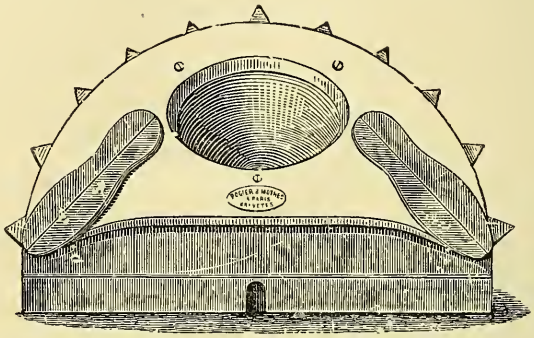


Fig. 131.—Privy à la Turque (Rogier-Mothes).

In privies of this kind the ground is paved with asphalte, and slopes towards a small opening placed below in front of the cuvette. By this the urine flowing on to the ground finds its way into the discharge-pipe. One of the most important duties of the porter is the cleansing of the privies.

Utilization of Night-Soil.—One of the principal disadvantages of privies, either fixed or moveable, is the necessity for having places for the deposit of night-soil near the city. There are twenty such in the suburbs of Paris. In order to lessen as much as possible the resulting evils, depôts for the manufacture of powder and sulphate of ammonia have been established. The largest of these is at Bondy, 13 kilomètres from Paris. It has large reservoirs for the night-soil, which is conducted to them in pipes by the pressure of a driving-pump placed at the depôt of La Villette, in the north of Paris. In order to destroy deleterious gases, they are conveyed to a furnace, where they are burnt.

The transport of the night-soil, etc., is undertaken by contractors.

At Bondy the night-soil is deprived of its moisture by evaporation. The ammonia given off is absorbed by sulphuric acid. The residue, mixed with lime, is sold as powdered manure.

Sewage Farms at Gennevilliers and D'Achères.—Attempts at irrigation were begun in 1867 at Clichy, near Paris. The results obtained were judged to be so favourable that more experiments were tried on a larger piece of land on the left bank of the Seine at Gennevilliers. At the same time a meteorological station was established at the same place, that regular observations might be made.

Analyses of the sewage and of the effluent matter from the sewage-farms

are made periodically. The analyses made monthly since 1887 are both chemical and bacteriological. Taking the average, it is seen that there are—

In the Sewage.				In the effluent water.	
Nitrogen.			Total of combustible matter.	Nitrogen total.	Total of combustible matter.
Fixed.	Volatile.	Total.			
8·2	9·2	17·6	389·8	0·4	130.6

The celebrated bacteriologist, Miquel, has also carried on researches relating to the numbers of bacteria contained in the same water. In each cubic centimètre he found on the average—

Sewage,	Effluent water,
23,000,000.	1,500.

The last number is the same as the pure water of the Varne.

Among the different forms of microbes discovered in the sewage, there are about 20 per cent. of bacilli, 40 per cent. of micrococci, and 40 per cent. of other forms of bacteria.

Miquel reckons the number of pathogenic bacteria contained in sewage at a little more than 1,000 in the cubic centimètre. The sewage farms at Gennevilliers now cover 60,000 acres.

The soil is drained by means of porous pipes, which conduct the water into 5 large drains, whence it falls into the Seine. The water of these 5 drains is not of equal quality. The most pure is that of the drain of Asnières, which flows through the land devoted to meteorological experiments, and which contain 0·2 of nitrogen, and 89·8 of combustible material.

In a cubic centimètre of this water there are about 54 bacteria, proving in a decisive manner that earth possesses the property of retaining bacteria.

In its progress across the garden belonging to the meteorological station, this drain forms an open canal, the bed of which is ornamented with small pebbles, giving a peculiar charm to the stream. The water is limpid and bright, and is often used as drinking-water.

Do not these millions of microbes remaining in the land threaten great danger? Observations continued since irrigation was begun have shown that disease cannot be attributed to this cause either in England or elsewhere. As yet this fact has not been explained in a satisfactory manner. It is admitted that the struggle for existence plays the principal part in it, and that the microbes which transform organic substances into inorganic compounds, destroy, at the same time, all the other bacteria.

Land well prepared, so that this action may regularly go on, would seem, therefore, to be one of the surest means for the destruction of pathogenic organisms.

Experiments made in Germany, where it has been attempted to cultivate the cholera microbe in privies, demonstrate that it perishes there in a very short time.

The beautiful researches of Miquel have further demonstrated that bacteria cannot be evaporated with water, and that they are retained by moisture. Air filtered through the earth, moistened with sewage, is completely deprived of microbes; also, water filled with decomposing substances, evaporated and condensed in a sterilized receiver, contains no trace of bacteria.

The sewage-farms of Gennevilliers receive first the overflow of the north sewers, a branch of which is directed towards Saint Omer, where it clears the Seine. This direction has been chosen in order that the water may flow by simple gravitation. A powerful pumping apparatus has, however, lately been established at Clichy, not far from the mouth of the Asnières sewer, which feeds a considerable part of the land at Gennevilliers, and is intended to hold back the water as far as Achères when the irrigation is begun.

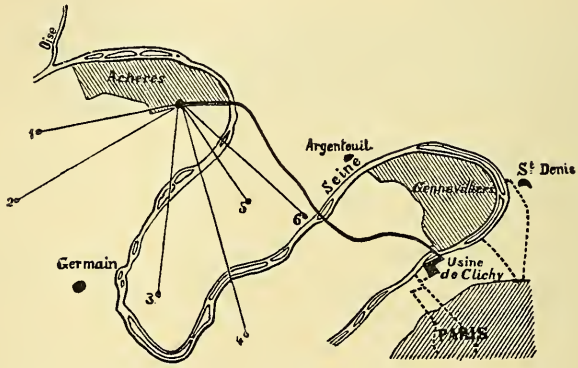


FIG. 132.—PLAN OF GENNEVILLIERS AND ACHÈRES.

1. Achères, 6 kilomètres distant. 2. Poissy, 8 kil. 3. Le Vésinet, 8 kil. 4. Rueil, 10 kil. 5. Houilles, 5 kil. 6. Bezons, 7 kil. distant.

Fig. 132 shows the disposition of the land at Gennevilliers, and the new land near Achères adjoining the great sewer of Clichy. The lines drawn from the latter show the distance between the sewage-farm and the neighbouring places.

Paris owes the enlargement of its sewage-farms to Alfred Durand-Claye, Director of the Sewer Service and of the Sanitary Improvements of Paris. It is to him also that the definite adoption of water-closets is due.

The land at Gennevilliers belongs to private persons who cultivate them. The city bears the cost of the drainage works. The land at Achères is the property of the State. It will be divided and let to agriculturists. At Gennevilliers the soil is composed of sand mixed with clay. The crops are various, but vegetables are chiefly grown: cabbages, 20 to 40,000 the hectare; artichokes, 60,000 the hectare; beet-root, 100,000 kilogrammes to the hectare. Large orchards, the trees loaded with delicious fruit, occupy a great space. Flowers are also cultivated. Some of the land has been turned into meadows which feed 800 cows. The irrigation of the

meadows and arable lands is managed by flooding them. The vegetables grow on ridges at the bottom of which the water flows. The market-gardens are watered two or three times a week. The meadows are only watered after the cutting of each crop, about 7 times during the summer.

The experience thus gained on a great scale and for a long period, will certainly end in completely overcoming all opposition to the irrigation of sewage. The land at present used by Paris for this purpose covers too small a surface. If a hectare be allowed for 250 persons, Paris would need 10,000 hectares. When this extension has been made, and the system of water-closets enforced by law, the sanitary improvement will be so great that Paris will become one of the healthiest cities in the world.

Stables and Cowsheds.—At Paris, as in all towns of more than 5,000 inhabitants, stables and cowsheds must conform to the following regulations for unhealthy, offensive, and dangerous establishments.

A stable must be at least 3 mètres in height measured from floor to ceiling.

The ground must slope and be impervious to moisture, so that the urine may flow to the sewer, or where no sewer exists, to a watertight cesspit, which must be emptied in the way prescribed for privies.

The ceiling, which is indispensable, must be plastered. If any one lives over it, it must be made of iron.

In stables ventilation must be secured by means of ventilating-shafts ascending to the top of the roof, and at least 0·40 mètre in diameter.

The walls must be white-washed with lime once a year. Plenty of water must be used for washing stables and cattle-sheds, yards and gutters.

20 cubic mètres of space must be allowed for each cow, and a floor-space of at least 1·50 mètre.

The sheds must be at least 4 mètres wide for one row of cows, and 7 mètres for two rows, if the mangers are fixed to the wall; 8 mètres if they are in the centre.

The dung must be deposited in a water-tight pit, or on an impervious floor. It must be removed at least three times a week during the summer, and twice during the winter.

If the dung-pits are near houses, a double wall must be constructed.

If the depôts for forage are placed by the side of the stables, they must be separated by a wall in masonry. If they are placed above, the floor must be cemented or paved. The reservoirs for malt, or other fermenting substances used for food, must be hermetically closed, and placed under a roof furnished with a ventilating shaft.

Abattoirs.—In Paris cattle can now only be killed in the municipal abattoirs. They are 4 in number: La Villette, Grenelle, Villejuif and Les Fourneaux.

At Pantin there is a special abattoir for horses; in the abattoir at Villejuif there is a separate place for killing these animals. A veterinary surgeon who lives there is charged with the oversight and inspection of

beasts before and after slaughter. The meat is nearly always used for sausages.

The newest and largest abattoir is at La Villette, Flanders Road, between the canal of the Ourcq and the canal Saint Denis.

The slaughter-houses are arranged on the same plan as the markets. They are composed of long buildings parallel with one another. The space between them is covered with glass, and forms the work-yard; the ground is paved with cement, and has a fall towards the centre. Here a trench is placed, and during work-time a current of water flows continually through it, carrying the liquid and other refuse to the sewers. Taps for water are placed wherever necessary.

The buildings on the two sides of the work-yard are divided into compartments called échaudoirs, having two doors, one of which opens on the street, the other on the yard. In each échaudoir there are two beams of iron on which the meat is hung. The floor is cemented as in the work-yards.

The slaughtering may also be done in the échaudoirs.

Above each échaudoir is a room for the butcher's clothes and stock of tools.

The intestines are taken to covered yards where those intended for sale are emptied of their contents. The remainder, with the dung, are taken out of the city in barges or carts without any previous preparation.

The slaughter-house also includes lairs for the cattle. These are paved with stone. Trenches behind the stalls conduct the urine directly to the sewer. The manure is taken away with the contents of the intestines of the beasts slaughtered. They are kept clean by constant washing.

All the establishments necessary for making sausages, puddings, tripe, etc., etc., are on the spot, also places for the extraction of albumen, preparation of guano from blood, melting of tallow, etc. The provision of water is everywhere plentiful, and the order and cleanliness of the place excite the admiration of visitors.

The yard is paved with stone.

Market for Cattle at La Villette.—This market, the largest in Paris, is situated near the great abattoir of the same name, the two being separated by the canal of Ourcq and connected by two bridges. Several doors of the market open on to the rue Allemagne, and there are passages thence to the railway station and the canal. It is open every day, but Mondays and Thursdays are the chief days for wholesale traffic. An enormous number of cattle arrive the evening before and are placed in the numerous stalls. On market day the animals are taken early in the morning to yards set apart for the sale of each kind. These are vast covered sheds; the one in the centre is for horned cattle, and may contain about 5,000. The one to the right is occupied by calves and pigs, and that to the left by sheep, sometimes as many as 25,000.

Bulls are of much less value for butcher's meat than other horned cattle; they are placed apart in the abattoir, the number rarely exceeding 200.

The dung, deposited in a suitable place near the canal Saint Denis, is removed by water-way. There is an abundant provision of water for washing the stables, sheds, etc. The ground is paved.

Every market day the cattle are examined by veterinary surgeons before opening the sale. They are assisted in the work by the herdsmen, who bring the suspected animals, open their mouths, etc.

If any beast is found to be affected with a contagious disease, the name and address of the owner of the animal are immediately written on a ticket. This note is sent with the beast to the abattoir and must be returned to the veterinary surgeon with the signature of the inspector of slaughtering, stating that the infected animal has been slaughtered. It is also the business of the inspectors to see that the stables, quays of disembarkation, and waggons are disinfected.

Owing to this rigorous inspection of living animals a great number are purchased by country people. Milch cows are also sold for the city dairies.

Preventive Measures against Contagious Diseases.—*Vaccination.*—France is one of the countries in which vaccination is not yet compulsory. It is, however, in good repute, and the government uses every means to induce the public to submit to the operation. It is a necessary preliminary to admission to certain public establishments.

According to the sanitary legislation, the Consulting Committee of public Hygiene in France is bound to promote vaccination, and the Councils of Hygiene have the superintendence of it. Several large cities have also founded institutes for vaccination.

The chief direction of vaccination belongs to the Academy of Medicine in Paris. Vaccination is performed there gratuitously three times a week. The Academy also sends vaccine to all doctors who ask for it.

The French Society of Hygiene in Paris, under the auspices of its zealous general secretary, Doctor P. de Pietra Santa, has displayed the greatest activity in promoting the use of vaccine in all classes of society. For a long time the Society has performed vaccination gratuitously with animal vaccine and sends it freely to the provinces.

There are also private establishments in Paris for vaccination. The oldest and most important was founded in 1871, and belongs to M. Chambon. He only uses the vaccine of heifers. The vaccination is done directly from the calf to the arm.

In virtue of an arrangement with the authorities M. Chambon performs the vaccination in Infant and Military Hospitals and Asylums. In these cases the calf is taken in a cart to each hospital. The vaccine is also sent into the country if requested.

The operation in calves is performed on the right side of the abdomen. All the part between the legs in front and behind, from the middle to the commencement of the cartilage of the ribs is shaved. 150 to 175 incisions, 2 centimètres long, and from 3 to 4 cm. apart are made. The virus is then introduced and spread a little with the finger.

The vaccine is subsequently collected by pressing each vesicle with a forceps; 8 to 20 are opened each time. The outer crust is removed and the vaccine is collected in capillary tubes. If it is necessary to preserve it for some time a third part of glycerine is added. The vaccine virus is first collected into large tubes, and afterwards put into smaller ones. They are closed by steeping them in a mixture composed of one part of fat and two parts of paraffin after which the whole tube is plunged into collodion. The lymph only is sent away; vaccination on the spot is performed with the pulp collected on the lancet in scraping the vesicles.

In the spring, vaccination is performed in every arrondissement of Paris at the expense of the City. Bills inform the people and invite them to attend. In order to induce poor people to bring their children, a small gratuity in silver is given to them.

Isolation and Care of the Sick.—Of all branches of public hygiene the prevention of infectious diseases is the one which makes the absence of a code of hygiene, and of a central sanitary direction, most regrettable.

In Paris preventive measures are under the jurisdiction of the Prefecture of Police, the Prefecture of the Seine, the Relief Board, and the municipality. It is evident that under these conditions the system leaves much to be desired. No compulsory notification of infectious diseases is enforced except for lodging-houses. It is true that the Bureau of Statistics attached to the Prefecture of the Seine, distributes orders for notification to all the doctors; but even admitting that these are regularly sent in, they are only at present valuable as statistics, inasmuch as they are not regularly followed by the adoption of preventive measures. Disinfection and the removal of the sick depend on the municipal authorities, while the treatment of patients is assigned to the Relief Board.

Persons attacked with infectious diseases are received into all the hospitals with the exception of small-pox patients, who are only admitted into the hospitals of Saint Louis and Saint Antoine, where there are isolated buildings for their reception. In the other hospitals the infected are also isolated, but experience has proved that the measures taken for that purpose have not been effectual, and it too often happens that infection is propagated within these establishments. Statistics also demonstrate that there has been an increase in the deaths from infectious disease in Paris, while they have sensibly diminished in other cities where isolation is better organized. Thus the mortality from infectious disease in Paris from 1865 to 1869 was 3·20 per 10,000 inhabitants; from 1879 to 1883 it was 5·78. In London during the same periods it fell from 3·62 to 2·64.

There is a station established at the Hotel Dieu in connection with the transport of infectious cases, in which are kept, two horses, two carriages and a driver. When any person ill of a contagious disease requires to be taken to the hospital, notice is sent to the nearest Police Station, whence it is transmitted by telegraph to the Prefecture, who then sends orders to the Hotel Dieu. The disinfection of carriages is prescribed by the regulations, but this duty is left to the driver, without supervision. An

important scheme relating to the isolation of ambulances and hospitals, has been elaborated by a Special Commission, which visited London for that purpose. This plan was presented to the Municipal Council by its secretary, Dr. Chautemps, and adopted June 17th, 1887.

Before the decision of the Council can take effect it must receive the approval of the Council of Health, and the building sites must be fixed. However the question is far enough advanced to make it certain that in the near future the city of Paris will have a properly organized sanitary régime.

Ambulance Stations.—The above-named scheme provides for two ambulance stations, one on the right bank near the Hospital of Saint Antoine, the other on the left bank near the Hospital for Sick Children.

Each of these Stations will have twelve carriages for the removal of the sick. Two will be reserved for small-pox, two each for measles, diphtheria, scarlatina and typhoid fever. The last two will be kept for other diseases; whooping cough, erysipelas, etc. The carriages reserved for one disease must never be used for another. Each coach-house must be divided into six compartments in order to prevent mistakes.

The stable must be arranged for six horses, though it will not be necessary to keep more than two in them under ordinary circumstances.

A certain number of nurses will be assigned to each ambulance to accompany the patients. They will live in the adjoining hospital, and give their services in turn.

The staff of the Station will consist of a chief officer, two coachmen, one of whom must be married, and a servant who might be the wife of the latter. All these persons will live on the premises, and the staff as well as the nurses will be boarded there. The cost of construction of each Station is calculated at 70,000 francs. Each carriage will cost about 2,500 francs. The latter will be made like those in London, with a seat for the nurse near the pillow of the patient, and should have a drawer for clothes and linen as at Brussels.

After each journey they should be washed with plenty of water. The Stations will be connected by telephone with the Relief Board and the Prefecture.

Hospitals.—In connection with the above scheme, four hospitals will be erected near the gates at the entrance of the city. Two will be devoted to small-pox, one to diphtheria and one to measles.

The first two should each have 70 beds; a piece of ground in the neighbourhood should be reserved so that in case of need supplementary pavilions might be constructed with accommodation for 80 more patients. The ground must be levelled, covered with asphalte, and provided with drainage, so that the temporary premises could be put up in a few days.

In case even more accommodation should be needed it is proposed to build a hospital for convalescents at Créteil, at the south-west of the City, on ground belonging to the Relief Board.

The experience at the Hospital for Sick Children, where there is a separate

building for diphtheria, has proved that this mode of isolation does not prevent infection from being carried to the other patients. The disease is communicated by the doctors, the students and the attendants.

The number of beds is also insufficient. A hospital for isolation should be built in order that the sick may be removed when it can be done without danger.

This establishment is to be placed near Bicêtre, at the southern end of the city.

To complete the arrangements for isolation at the buildings now in use, each block should have a separate staff of officers and separate kitchens.

The necessity for energetic measures for arresting the progress of diphtheria, will be clearly shown by the subjoined figures.

Mean Death-rate from Diphtheria per 10,000 *Inhabitants :—*

From 1865 to 1869	4·32
,, 1870 to 1874	4·72
,, 1876 to 1879	8·88
,, 1880 to 1884	9·26
,, 1885 to 1887	7·68

As to measles, the most conclusive observations have lately been made by Antoine Béclère at the Hospital for Sick Children. They demonstrate that this disease is generally, almost exclusively, communicated in the early stages, and during the eruption. This explains why it is so easily propagated in schools, and as the number of schools increases, measles becomes more common.

In Paris the deaths have increased in the following proportion :—

Mean Death-rate from Measles per 10,000 *Inhabitants :—*

From 1865 to 1869	3·18
,, 1870 to 1874	3·35
,, 1875 to 1879	3·72
,, 1880 to 1884	4·90
,, 1885 to 1889	5·71

These figures show the necessity for the prompt isolation of the patients.

In the scheme above mentioned it will be a question whether there should not be a hospital at Ivry with 80 beds, having a separate department for doubtful cases.

Scarlet fever is comparatively rare in France, and the soil of Paris seems to be unfavourable to its development. Per 10,000 inhabitants the average mortality from scarlet fever has only been 0·9 in Paris, while in London it is 1·7, in Edinburgh 1·2, and in Berlin 3·2. It has therefore been thought sufficient to have a separate pavilion for this disease in connection with each hospital for children.

With the view of diminishing the spread of whooping cough it has been proposed to found a great establishment for isolation, including a school

and a hospital. This is however a project for the future; at present, it will suffice if isolated blocks are provided for that disease.

To avoid infection in dispensaries and consulting rooms in hospitals, it has been proposed to devote three rooms to infectious diseases, the patients being examined on their arrival, and sent into the buildings for isolation until the disease is clearly developed.

Disinfection.—In Paris the Prefecture of Police is entrusted with the duty of disinfection, and receives daily a list of the deaths in each district, with a notification of the cause of death.

When a case of infectious disease is discovered, the Prefecture informs the commissioners for that quarter by telegraph. The family receive from him a notice issued by the Council of Public Health, giving information as to the means which should be employed for disinfection. They are also informed that if desired the disinfection will be performed gratuitously by the public disinfectors.

If the family accept this offer, the Commissary of Police sends a message to the Prefecture, giving the name and address of the person whose house is to be disinfected. Some hours afterwards the disinfectors proceed with the work which is effected by means of sulphurous acid obtained by burning sulphur. During the time that the infected rooms are being fumigated (48 hours), the occupants of the rooms are lodged at an hotel in the neighbourhood, at the cost of the Administration if they are poor.

The quantity of sulphur burnt is at least 20 grammes to the cubic mètre.

Disinfection thus performed by the proper officials is more thorough than any which could be effected by private persons not having the necessary experience; but as it is not obligatory the results are unsatisfactory.

Most of the hospitals in Paris possess stoves for disinfecting by steam under pressure; in the suburbs there are transportable stoves, which are lent gratuitously at the request of the doctor.

When the scheme relating to ambulance stations and hospitals for isolation was adopted, the Municipal Council also approved a scheme which was presented by the same Commission for the purpose of regulating disinfection in Paris.

This scheme proposed that two disinfecting stations should be built, one at the north of the city, the other at the south, each comprising two sections completely separated, one for the reception of infected articles, the other for the same articles when purified.

The stoves being fixed into the wall dividing the two sections should be constructed so as to open on both sides. The infected articles are put in on one side and taken out on the other.

At the end would be a house for the superintendent, so that he could inspect the two sides at once from his windows.

The establishment should also include a bath-room for the disinfectors, who must wash after their work, and a laundry.

The staff will be composed of a superintendent, two disinfectors, an

engineer who will have charge of the purified articles, a person who will receive the infected articles and put them into the stove, two drivers, a book-keeper, and a servant, the wife of one of the workmen. All these persons will be boarded and lodged in the disinfected side of the establishment; the workmen in the infected part will be required to wash before meals and to take a bath at the close of the day, attending carefully to the hair and beard. They will change their working clothes before going to their rooms.

The stove shown in Fig. 133 is considered the best in France. It was constructed by two sanitary engineers, Geneste and Herscher. It consists of a large metal cylinder E, covered with non-conducting material, and arranged so as to open at each end. At the bottom of the cylinder are rails on which glides a frame-work, C, from which hang the infected articles. As this frame-work is drawn out from the cylinder, it is supported on the rails V V.

Within the cylinder at its upper and lower extremities are small high-

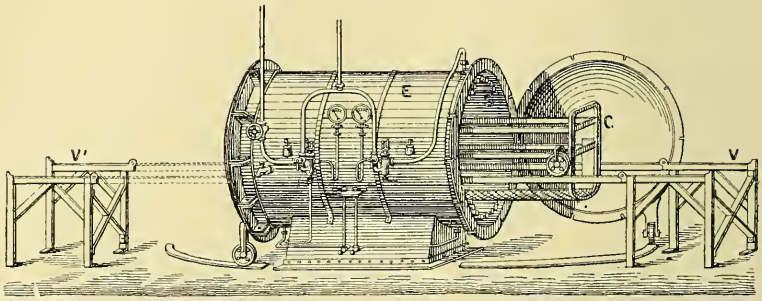


FIG. 133.—DISINFECTING STOVE (GENESTE AND HERSCHER).

pressure steam pipes. The upper set of pipes are furnished below with a screen, which prevents the steam from condensing in drops and making marks on the clothes, and facilitates the drying of the disinfected articles.

The apparatus is set in action by pressure, the safety-valve resisting a pressure equal to 0.7 kilogramme. The temperature can reach as high as 115° C.

The disinfection is complete in 15 minutes; drying takes 20 minutes. Five minutes after the steam is introduced it is intermitted for one-half to one minute.

Fig. 134 shows another apparatus for disinfection without a boiler; it was invented by Dr. Gibier and made by Pierrou & Dehaitre.

It consists of a boiler with its fireplace, and of three segments of galvanized iron, one over the other, and a cover, which like the segments is sealed by means of a thumb-screw. Above the boiler is a grating of galvanized iron, which like the sides is covered with non-conducting material.

This apparatus can be taken to pieces and put up in an ordinary room.

In this case the pipe by which the smoke escapes is conducted into the chimney of the room.

When the fire is lit and the clothes arranged in the stove, it will be seen how many sections are needed; when the steam begins actively to escape, the stop-cock is kept closed until the thermometer reaches 100° C.

The disinfection is accomplished in one or two hours.

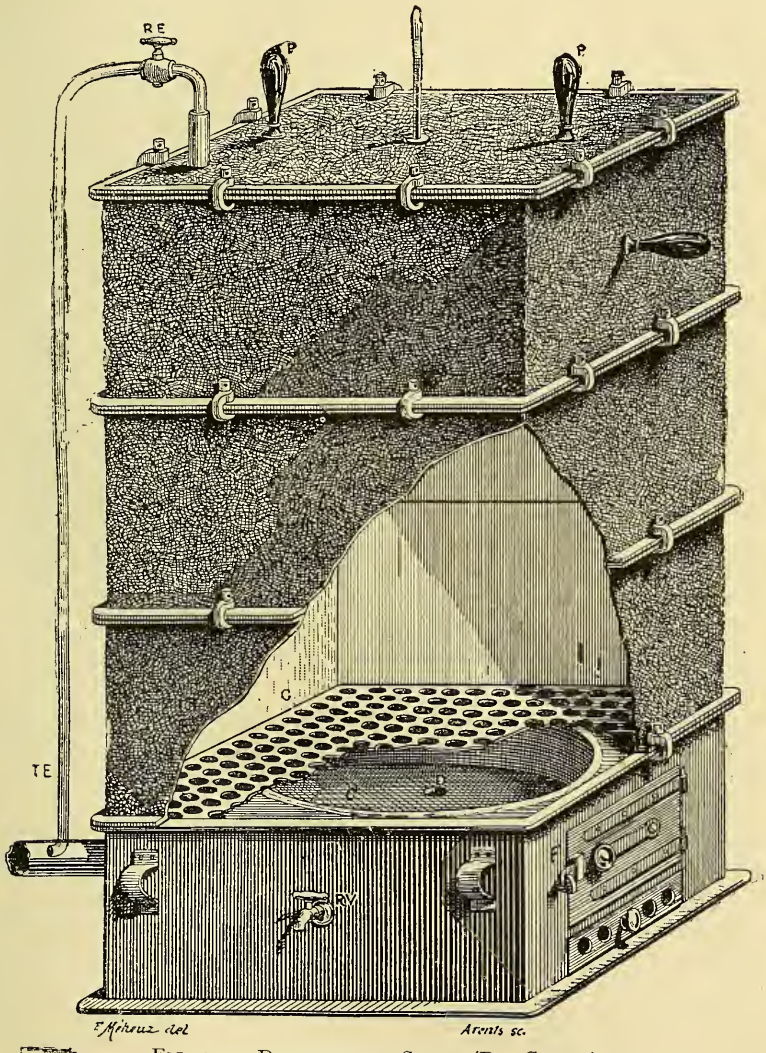


FIG. 134.—DISINFECTING STOVE (DR. GIBIER).

The clothing is covered with a thick piece of stuff to prevent injury from the steam, which becomes condensed in the upper part of the apparatus, and is subsequently dried in the open air.

An apparatus like this has been employed in the night refuge of the rue Bucherie since 1886. It has been of good service considering its small cost.

Such are the measures proposed for preventing the spread of infectious diseases. From the hygienic stand-point satisfactory results can hardly be expected until compulsory notification of cases of infectious disease is enforced and disinfection supervised by medical hygienists.

The only system which would have the desired result, would be the creation of a Bureau of Hygiene having a physician at its head, who would have in his hand all the threads of the hygienic service, and who would have the Bureaux of Hygiene of the arrondissements under his control.

The administration of justice could not be entrusted to persons unacquainted with law, and similarly persons without special knowledge cannot direct the sanitary organisation.

Mortuaries.—A plan for them has been prepared by a Commission of the Municipal Council, and was presented by its secretary, Dr. Chassaing. The members of that Commission have visited similar institutions in England, Belgium, and Germany.

By a decision of the 21st July, 1890, the Municipal Council of Paris has decided to establish a mortuary in each of the cemeteries of the east (Père-Lachaise) and the north (Montmartre).

The first of these was opened on the 15th December, 1890, rue de Maistre, No. 17, in an annexe of the northern cemetery. It consists of six parts separated by a passage. One of these serves for an inspection-room for bodies, the other contains iron tables covered with a mattress over which is a water-proof sheet. The body is placed on this bed and covered with a sheet. The walls of the room are oil-painted, the ground is impervious, the ventilation efficient.

Persons are allowed to remain with the corpse until 8 p.m.

The second mortuary in the eastern cemetery came into public use on the 1st June, 1892.

In accordance with the terms of article 5 of the decree of 27th April, 1889, the mortuaries are not available for the bodies of persons having died from infectious disease.

Bodies are only admitted to the mortuary—

(1) On the written application of the head of the family or some other persons competent to undertake the funeral. This application must state the name, surname, age, occupation, and dwelling of the deceased.

(2) On the production of a certificate of death from the doctor who attended the patient, stating that the death was not caused by infectious disease.

Up to the present time, these mortuaries do not appear to have been of great service, owing to the unwillingness of families to part with their dead before the time of interment.

"La Morgue," behind Notre Dame, only receives bodies on which a post-mortem examination is required, and the bodies of unknown persons placed there for recognition.

In the hall where the bodies are exposed, the temperature is kept several degrees below zero by a system of refrigeration, thus retarding putrefaction.

Cemeteries.—By virtue of a decree of the 7th of March, 1886, cemeteries must always be beyond the centres of population, and at least 100 mètres distant from wells and houses. The graves must be 2 mètres by 0.80, and 1·50 mètres deep. Private graves may be obtained by payment either as freeholds or on leases. If no payment has been made, bodies are buried in a common grave having the dimensions before indicated; there must be a space of 0·20 mètres between each coffin. At the end of five years the grave may be used again.

Families who have purchased freeholds often construct graves lined with masonry, and having a great depth. These graves are covered with flagstones which are raised for every fresh burial. The coffins rest one on the other, but the last must always be 1·50 mètres below the surface. Special regulations are issued for the prevention of accidents and nuisances by the repeated opening of the graves. The Administration is considering a new plan for the opening of a private cemetery for freehold graves. At the cemetery of Père-Lachaise a furnace for cremation has recently been built. It was opened to the public in 1889.

Prostitution.—At Paris it is well known that five times out of six syphilis originates from clandestine prostitution, which shows the peremptory necessity for subjecting persons who gain their living in that way to strict supervision. Registered women who have a private lodging are examined once a fortnight, those who live in a registered house once a week. If ill or suspected, they are sent to the prison of Saint Lazare, where they are kept until all danger of contamination has disappeared.

Public Buildings, Hospitals.—Most of the hospitals in Paris are of ancient date, consequently they have no particular interest from the sanitary standpoint.

The new establishments, such as the Hospital Tenon, the Hotel Dieu, the Hospital Lariboisère, the Lying-in Hospital, Clinical Hospital, etc., etc., are constructed on the plan of isolated pavilions, with a central apparatus for warming combined with ventilation. The ventilation is generally by aspiration, the air being drawn in below, and the vitiated air extracted above. Most of these hospitals are splendid buildings. The Hotel Dieu, which contains 450 beds, cost forty millions of francs. In respect of hygiene and practical organisation they cannot bear any comparison with the English hospitals, which have been described before.

Houses for Working Men.—The question of housing the working classes in Paris has engaged the attention of the Administration, and of private persons for a long time. In 1852, ten millions of francs were given by Government for the purpose of improving the dwellings of working men. This sum was given in the form of subsidies, which might amount to a third of the cost of the buildings if the plan were approved by the authorities.

A subsidy of 300,000 francs gave origin to the workmen's town of

Mulhouse (Alsace), of world-wide reputation. The Company then constituted has built 986 houses arranged either in groups of four or in rows. The blocks are considered to be preferable. Each building forms a square separated from the others by plantations of trees. The latrines are placed outside the houses, and the contents are conducted into a water-tight pit.

The alleys separating the houses are broad, well-paved, provided with footways, and planted with trees. Fountains of excellent water are placed at intervals.

These houses have cost from 1,800 to 2,800 francs ; the price of the land is only 8 per cent. of this sum. By paying rather a higher rent the workman can purchase the house he occupies.

Houses with furnished rooms are provided for single persons of both sexes, but they cannot become owners.

No working man can sell his house unless the purchaser is approved by the Company. He must also engage to keep his dwelling clean and in good order, and to cultivate his gardens. Subletting is not permitted.

The working colony founded at Guise by an ironmaster, M. Godin, is very remarkable. It is a great establishment inhabited by M. Godin and his two hundred workmen, thus forming a single family, the name of the Family of Guise having been given to the colony.

Each inhabitant is most carefully tended from his birth until his death. A nursery is provided for the children. As soon as an infant comes into the world its name is written over the cradle intended for it. Whenever the mother is obliged to go out she has only to take her child to the place reserved for it, and may be sure that it will receive all necessary attention.

The older children receive an excellent education up to the age of fourteen. The teachers are well chosen, and use the best methods. The young people may afterwards choose whether they will take part in the work of the factory and become apprentices, or follow other callings more suited to their tastes. Each family forms a separate household, and can obtain everything it needs at wholesale prices. Medical care and medicine are supplied gratuitously.

There is a theatre, a library, and a hall for all sorts of games for the recreation of the workman in his hours of leisure. M. Godin has converted his business into a co-operative society, so that the workmen may become shareholders.

The first attempts at improving the sanitary conditions of workmen's houses in Paris were made by M. Valladon in 1848. He built a number of small houses, and let them to workmen who purchased them by the payment of rent for a term of years.

These houses have now been replaced by large buildings which no longer belong to workmen. The State has employed two millions out of the ten millions of francs allotted in 1852 in building seventeen houses on the boulevard Diderot. They have several storeys, each containing two tenements of three rooms with kitchen, and one tenement of two rooms also with kitchen.

A sum of 1,200,000 francs taken from the above-named allocation was granted to private persons wno engaged to spend three times that amount in buildings.

It was stipulated that the cost of the sites should not exceed 8 francs per square mètre, and that plans should be approved by the architect of the Minister for Public Works.

Afterwards some companies and private persons built a number of houses on the plan adopted at Mulhouse. The tenant was required to become the purchaser of his house by the payment of annual instalments. The Emperor Napoleon III. built 45 houses near the avenue Daumesnil, which he sold for 100,000 francs to a company of working men owning shares of 100 francs each. This company afterwards contracted a loan to enlarge the circle of its operations, but the enterprise brought in so little profit that these undertakings fell into disrepute.

No one has rendered more valuable service in this matter than M. E. Cacheux, who has made a thorough study of the question. In concert with M. E. Muller he has published a large work entitled "Houses of the working classes in all countries," which obtained the gold medal at the Health Exhibition in London. M. Cacheux bought building plots and erected blocks of houses which were afterwards bought by the tenants by the payment of annual rent. He has calculated that 100,000 tenements are still needed before the workmen of Paris can be provided with healthy dwellings. M. Cacheux is not discouraged by any difficulty; he has formed a project for constituting a society for carrying out his programme. It may be hoped that his efforts will be crowned with success.

Hygiene of Factories.—In addition to the regulations already mentioned (p. 271) respecting the hygiene of factories which are applicable to the whole country, there are special arrangements made for the city of Paris and the department of the Seine, relating to the inspection of these establishments. Twelve inspectors are employed to visit all the classified establishments in their districts at least twice in the year. The inspection should take place at fixed times. Any infractions of the regulations must be reported, and the inspector may propose any measures which seem to him necessary for the health and safety of the workmen. If any important changes have been made in the methods of manufacture or in the arrangements of the place, the inspector must report the fact, lest the changes should be of a nature to injure the public health.

The inspector must inform the administration if he finds any establishment without a licence. He gives notice of any requests for the licensing of new factories and examines into complaints of all sorts relating to the establishments in his district.

The twelve inspectors have a principal inspector at their head.

Hygiene of Schools.—French schools differ essentially from those of other countries, because they are usually boarding schools. In the primary schools, where this is not the case, the children are supplied at school with food at a low price. Those who bring their own food may warm it in the

kitchen of the establishment. Boarding schools include boarders, half boarders, and day scholars.

Sanitary oversight of schools is incumbent on the mayor of each arrondissement, and the Council of Hygiene belonging to it. The inspection of the hygienic condition of schools by medical inspectors was made obligatory by the law of the 30th October, 1886.

The inspection is made according to a special regulation including all arrangements relating to the health of the children and the conditions of the building.

Private schools are also included.

The inspectors are chosen from the doctors of the commune or the department; their nomination must be approved by the prefect. In the department of the Seine and Paris the medical inspection of schools has been regulated by a decree of the 13th of June, 1879. The regulation now in force was approved on the 15th of December, 1883, and includes the following directions :—

The schools in Paris are divided into groups. Each group has its doctor and is subject to revision every three years. Schools opened during the interval are attached to the nearest group.

The inspectors must be doctors of medicine ; they are nominated by the Prefect of the Seine from a list prepared by the Mayor of the arrondissement. The list must have two names for each office, and the inspectors are appointed for three years.

Each school must be visited twice in the month, or oftener if desired by the Mayor.

The inspector will visit the entrance-halls, yards, playgrounds, latrines etc., in company with the principal of the school, to whom he will make his observations, and, if necessary, mention any improvements which occur to him.

He then passes to the examination of the class-rooms, noticing carefully the arrangements for lighting, warming, and ventilation, also the furuiture. Afterwards he sees the scholars, especially any of them who may be pointed out to him as out of health, or delicate. The inspector examines teeth, eyes and ears, and gives a general account of the health of each child. The result of the inspection must be entered in a special register containing a detailed report on cleanliness, lighting, etc. The inspector will inscribe in a separate column the names of pupils who must be sent home because of illness, and indicate its nature or infectious character. He must note the number of children absent through illness, and the nature of the disease. If any pupil needs special care his family should be informed by letter.

Children attacked by an infectious disease are sent home at once, with a letter notifying that the child must not return without the sanction of the medical inspector, who will then give him a certificate declaring that he may return without danger.

The official Committee of Hygiene should send a list of infectious dis-

eases and the symptoms by which they may be recognised to the heads of institutions.

If the principal observes any alarming symptoms in a pupil, he must send him home at once with a letter explaining his reasons, and advising a visit to the school doctor. After recovery, the child must not return to school without a certificate from the doctor. This is also required for children who have been away from school voluntarily. In the last case the principal must obtain information as to the nature of the illness, and, if it is infectious, see that the regulations are observed.

The medical attendant of the school examines children who require certificates, at his own house, in consulting hours. Within twenty-four hours after inspection the doctor must draw up a report on the state of the schools under his care and send the forms prepared for that purpose to the Mayor. The reports of the doctors must be examined by the Mayors. If he observes anything in them of importance, the superior authorities must be informed immediately. Minor matters are brought before school Committees.

When epidemics prevail, and at the express request of the medica inspector, the Mayor possesses the right to close the school; but he must then inform the administrative authorities. The Mayor presents quarterly reports to the School Council containing the results of the inspection, and at the end of each half-year the Council draws up a detailed report on the inspections made in each group. The improvements recommended by the doctor are stated, with the reasons for them.

Of late public opinion has been strongly against over-pressure in schools. The question has been brilliantly and sensibly treated by the French Society of Hygiene, and by the Academy of Medicine in Paris.

In the hope that the government will soon take general measures against over-pressure, some private schools have hastened to profit by the new ideas.

The first to take this line was the Monge school, which is justly regarded as a model. We shall therefore describe it particularly, illustrating with figures, which we owe to the kindness of M. Godart, the eminent principal of the school.

The Monge School.—Like most French schools, the Monge school receives boarders, half-boarders, and day scholars.

Children are allowed to enter a special division from the age of five years. The young people pass through the preparatory school to the government schools.

The Monge school is situated on the boulevard Malesherbes, in one of the new quarters of Paris. It is built on ground open on all sides, and covers a space of 11,128 square metres. The nature of the ground and arrangement of the buildings, are shown in Fig. 135. There are three stories besides the ground floor.

In the centre is a large space with a glazed roof, a kind of covered yard,

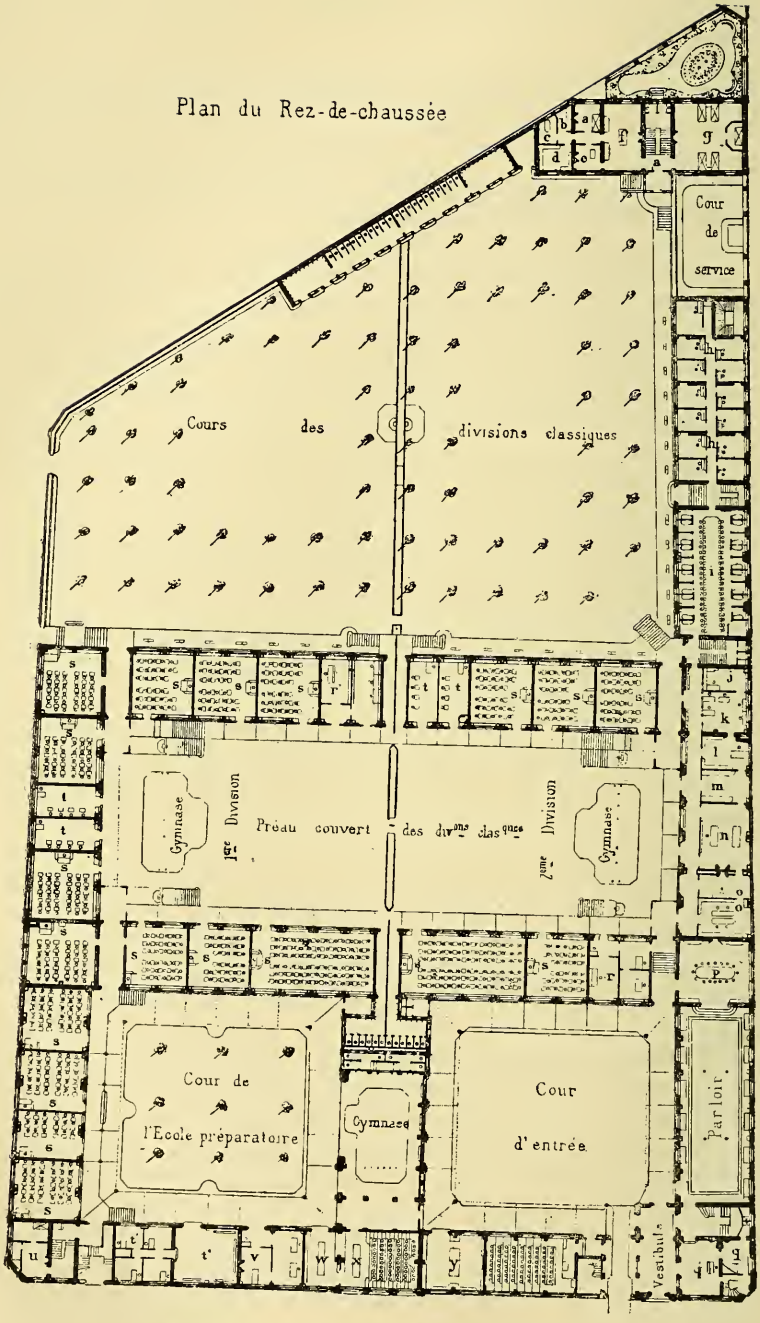


FIG. 135.—PLAN OF THE MONGE SCHOOL.

2,800 square mètres in extent, where the pupils amuse themselves in bad weather. Large balconies run along the first and second stories, overlooking the play-ground. The latter is divided into two parts, each having a gymnasium.

The glass roof has in its centre a higher roof, with vertical sides, $1\frac{1}{2}$ mètres in height, and made to open, so that air is freely admitted by sashes.

There is a special carriage entrance for the establishment. The preparatory school, the classical department, and the infirmary, have each three separate courts.

The hospital is in the most retired part of the grounds, and is completely detached from the other buildings. It includes on the ground floor a room for servants (*a*) and a kitchen, baths (*c*), the dispensary (*d*), consulting room (*e*) and a sitting room for convalescents (*f*). There is a large ward for the sick (*g*) at the end of the building.

The upper storey includes a room for infectious diseases, and a place for any mother who may wish to nurse her own child.

The other letters marked in the plan designate music-rooms (*h*), bath-rooms (*i*), office, counting-house, superintendent's room (*j k l*), waiting room (*m*), principal's room (*n*), secretary's office (*o*), committee-room (*p*), porter's lodge (*q*), censor's room (*r*), class-rooms (*s*), rooms for recreation, examination, and play (*t t t*), inspector's room (*u*), masters' rooms (*v*), laboratory (*w*), grand amphitheatre (*x*), and physics laboratory (*y*).

The first storey is occupied by class-rooms, rooms for drawing, teachers' rooms and dormitories. The second by dormitories, etc. The kitchen, pantry, cellar and dining-rooms are in the basement.

Class-Rooms.—The class-rooms are 10 mètres by 8 in breadth, and 4 mètres in height. The maximum number of pupils is 30 for each. The walls are painted in oil to the height of one mètre; above this they are covered with yellowish paper, the colour of maize.

They receive light from the sides, but more directly from the left, as the light from the right side comes from the covered play-ground round which most of them are built. The class-rooms, which do not open on the play-ground, have their windows on the right fitted with ground glass to soften the light. The upper sashes of the windows move vertically, sliding in a groove, so that they can be lowered (*fenêtres à guillotine*).

A central system of heating by hot water is combined with ventilation for the whole place.

The foul air is drawn into two rooms under the roof, which are maintained at a high temperature by stacks of hot-water pipes. In summer they are warmed by two small boilers.

The openings for ventilation are calculated to supply 25 to 30 cubic mètres of fresh air per hour to each pupil. The temperature is maintained at 14° to 16° Centigrade.

The artificial lighting is effected by gas-lamps fixed to the ceiling, and provided with shades, which are inclined to the horizontal at an angle of 30°.

In front of the black-board is a lamp with a vertical reflector, which throws the light on to the black surface.

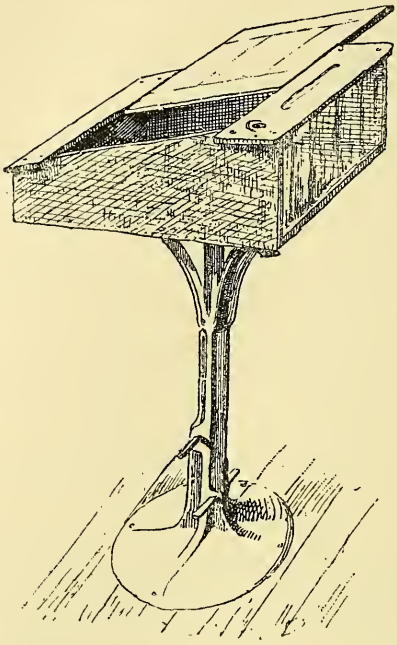


FIG. 136.—DESK AT THE MONGE SCHOOL.

Each burner is provided with a regulator (*rhéomètre Giroux*), which keeps the flame at the same intensity. Gas is not used in ventilation.

Each pupil has his desk, which rests on an iron foot screwed to the floor, and a chair with a moveable back (Fig. 136).

Some of the water-closets adjoin the play-ground, others at the end of the yards for recreation, near the dormitories. They are divided into compartments. The walls are entirely faced with tiles. The floor is of oak. The seat is an iron cylinder fitted to a porcelain pan ending in a discharge-pipe, which opens into a filtering-tub. The seat is of polished mahogany, which can easily be removed for washing.

The small size of this seat prevents the pupil from putting his feet on it, thus teaching the children to seat themselves properly. Each apparatus is completely isolated. Below the wooden seat runs a copper pipe pierced with holes communicating with a cistern, which supplies water for cleansing the pan. The small stream of water from the pipe is not sufficient for cleansing. According to the French custom, a person is employed to complete the cleansing with a brush. The discharge-fall pipe has no syphon, and is not otherwise trapped.

Each closet-pan has its discharge-pipe, which joins the soil-pipe, and

has the same diameter as the latter. The soil-pipe passes down the wall, and has a ventilating-pipe heated by gas.

This system is considered satisfactory. It is, however, too complicated for imitation. Besides, it needs a person always in attendance to clean the pans every time they are used. There is really as abundant a supply of water as in English water-closets, but it is not used in such a manner that bad odours are avoided.

The urinals are built against the wall opposite the water-closets. They are constantly flushed by a small stream, and are perfectly constructed.

In no country is the accusation of over-working the pupils more justified than in France. The Monge school has adopted new ideas; yet, the classes last from half-past eight in the morning, till half-past five in the evening. There is an interval of an hour and a quarter for breakfast about noon, and three recesses, the first half an hour, the others a quarter of an hour each; but altogether there are only two hours and a quarter of leisure in the day.

The pupils in the preparatory division work nearly as long, their time for recreation being only two hours and a half.

The afternoons of Thursdays are devoted to excursions, the half-boarders and day scholars not being obliged to take part in them. The children are taken to the country in carriages belonging to the school. If the

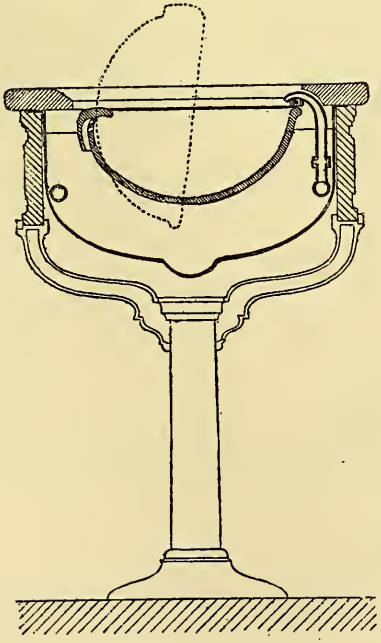


FIG. 137.—WASHSTAND.

weather is bad, they go to the museums. These excursions are so arranged as to aid in their instruction.

The success of these excursions, from a sanitary standpoint, has induced the directors to arrange to have them daily, the pupils being sent to spend three hours on the grass in the Bois de Boulogne. This régime has been followed for more than a year, not only with the most excellent results to the health of the children, but with improvement of the work done, and diminution of the strain upon the children. During holidays the pupils take more distant excursions under the charge of a teacher, even visiting foreign countries.

There are three meals a day at the Monge schools; coffee or chocolate at 8 a.m., breakfast at 11.30 a.m., composed of meat, vegetables, and dessert; dinner at 6 p.m., soup, meat, vegetables, and dessert. The children receive a piece of bread between the two principal meals.

The large dining-room or refectory is in the basement. It is 4·20 mètres

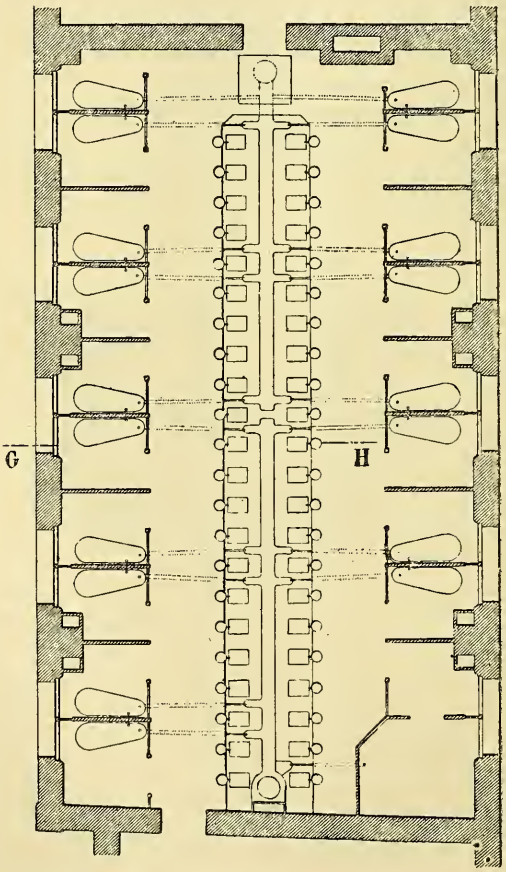


FIG. 138.—BATH ROOM.

high. The tables, which are arranged in two rows, seat ten persons each. The floor is cemented; the walls are faced with tiles. The ceiling and pillars are painted in oil and varnished.

The tables are made of marble, the forms of polished mahogany. At the two ends of the rooms are water taps, to which are screwed pipes for watering, so that the walls, floor and ceiling can be cleaned by sprinkling. By this means all odours are removed.

A corridor runs alongside of the dining-room, having taps of metal with a trench beneath. Here the pupils can wash their hands before meals.

The ordinary temperature of the rooms is from 14° to 16° C.

The dormitories are large rooms containing from 24 to 32 beds, separated from one another by a partition 1·80 mètres in height. These cubicles have separate doors. The washstands are placed in the middle of the room, as shown in Fig. 137.

The apparatus consists of a slab of marble, in which are placed moveable basins, swinging on an axis. Below is a trench for the dirty water, which flows to the water-closets, and helps to flush them, Each washstand is numbered to correspond with the bed. Each dormitory has a cupboard and a room in which clothes are brushed.

The dormitories are painted in oil, a bright colour. Their temperature in winter should be from 10° to 12° C.

The bath-room is in the basement. The arrangements are shown in Fig. 138. Each bath is in a little cell. In the middle of the room are two rows of basins, at the floor level for foot-baths, having each a seat before it.

Two rooms are set apart for vapour-baths, and hydropathy.

The water for the baths comes from two cisterns placed in the roof. It is heated by a steam boiler in the basement.

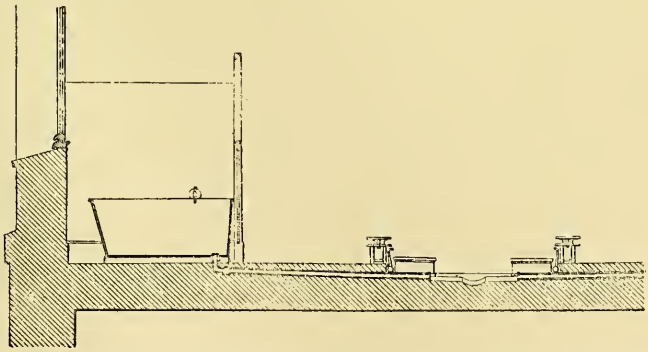


FIG. 139.—SECTION OF BATH-ROOM, TAKEN AT G H IN FIG. 138.

The temperature of the bath is regulated from above, so that a single tap suffices for the preparation of the bath. When the water leaves the

bath it flows into a little runnel, which passes between the two rows of basins shown in Fig. 138.

The temperature of the room is maintained at from 18° to 20° C.

The boarders take a bath once a fortnight, and a foot-bath twice a week.

The school has a medical man on its staff. If a pupil has been absent on account of illness, he is not allowed to re-enter the classes until he has been examined by the doctor, to whom he must bring a written certificate from the doctor who has attended him.

A dentist examines the mouth of each child once a month, and if an operation is necessary the parents are informed.

GERMANY.

CHAPTER I.

SANITARY LEGISLATION.

General Remarks.—Sanitary Administration.—Sanitary Legislation.—Foods.—Inspection of Pork.—Regulations concerning the Flesh of Tuberculous Animals.—Inflation of Meat.—The Milk Trade.—Legislation forFactories.—Laws relating to the Insurance of Workmen against Sickness.—Local Relief Office.—Local Regulations for Relief Offices.—Relief Offices for Factory Hands, Builders and Artisans.—Law of Insurance against Accidents.—Precautions against Accidents and Control of Factory Work and Mutual Insurance.—Imperial Bureau of Insurance.—Vaccination.—Regulations relating to Foods and Drinks.—Instructions concerning Vaccination.

Laws for the Prevention of Infectious Diseases.—General Arrangements.—Notification of Cases of Infectious Disease, and Measures to be taken.—Classified Statistics of Diseases.—Supplementary Measures.—Regulations for the Organisation of hospitals for Infectious Diseases.—Measures for Isolation.—Disinfection.—Measures relating to Infectious Diseases in Schools.—Syphilis.—Hospitals.—Corpses and Graves.—Cemeteries.—Protection of Children of Tender Age.—Kindergartens and Infant Schools.—Contamination of Streams.—Measures to be taken in case of Inundations.—Measures relating to Buildings.

General Remarks.—Germany and England are incontestably the countries in which the science of hygiene has met with its best champions. But though modern hygiene has been the subject of profound study in Germany, the administration of the laws relating to the public health, with few exceptions, is still left in the hands of the police, as in France. The country is still without a general sanitary law. There is no lack of detailed and precise regulations, but as the orders are not classified, the entire collection must be consulted in order to understand them. For this reason most of them are unknown to the mass of the people.

The confederation of Germany possesses a Federal Council, and among the regulations which are applicable to the whole Empire are those which refer to the public health.

The separate States have the right to lay down rules for themselves, lways providing that they agree with the fundamental principles of the general laws.

Allowance being made for the imperfections indicated above the importance of hygiene is more fully acknowledged in Germany than in any other country on the Continent.

A knowledge of hygiene has been made obligatory in future examinations

for doctors, and the medical hygienists of the districts submit to a rigorous examination on all questions relating to the public health.

The following statistics show that the efforts made in this direction have not been unfruitful, since the mortality per 1,000 inhabitants which was on the average 27·9 from 1872 to 1875, dropped to 26·1 from 1876 to 1880, and to 25·8 from 1880 to 1884.

Sanitary Administration.—The Chancellor of the German Empire has the principal direction of the public health. He is assisted by a consulting council which was instituted at Berlin in 1876, under the title of the Imperial Office of Health.

The duties of this council are as follows:—It collects information as to the sanitary legislation of other countries, prepares new laws and sanitary regulations, also exact hygienic and medical statistics.

It is composed of a director, 4 ordinary members, 8 medical assistants, and a chemist. Most of the assistants are military doctors appointed to perform these duties in turn. Besides the above, the Committee or Council of Health includes 25 honorary members, chosen from different parts of the Empire, doctors, engineers, architects, apothecaries, and veterinary surgeons. They are only consulted when problems of general importance require solution.

In the separate States on which devolves the duty of watching over their individual sanitary services, the Minister of Public Instruction has the direction of the Council, or, failing him, the Minister for the Interior.

In Prussia the Minister of Public Instruction has also the title of Minister of Ecclesiastical and Medical Affairs. A special section placed under his direction undertakes the management of hygienic and medical questions. It comprehends 5 consulting members, 3 of whom are doctors.

A scientific and medical commission, and a technical department for pharmaceutical subjects assist the Ministry under the title of consulting authorities.

As the sanitary administration of the different German States does not greatly differ from that of Prussia, and as its organisation is generally followed by the other States, we shall more particularly consider Prussia in this place.

The president has the charge of matters relating to the public health in every province. He is assisted by a Provincial Council which has no doctor on it; but on medical and hygienic affairs he consults a medical college of the province (Provincial-Medicinal-Collegium) composed of doctors, a professor of midwifery, the Director of Asylums, a veterinary surgeon, and an apothecary.

The functions of this college are:—To give advice on questions of hygienic and medical law; to propose the measures necessary in case of an epidemic; to furnish a periodical account of these functions in reports on the sanitary condition of the province.

Each province is divided into several districts (*Regierung-Bezirke*) having each a president assisted by a council, one member of which must be a

medical councillor (*Regierungs-Medicinalrath*). This last duty is usually entrusted to an old physician of the district (*Kreisphysicus*).

If the physician of the district resides in a place where there is a medical college, he is an *ex-officio* member of it.

In States of small extent the provinces coincide with the districts, and form an arrondissement (*Amt*) with an overseer (*Amthauptmann*) at the head.

The consulting physician of a district is entrusted with the superintendence of the sanitary service, medical affairs, and pharmacy; also the control of the Relief Board.

He is expected to make tours of inspection in his district every year.

The district is sub-divided into sub-districts (*Kreise*) in which the administrative authority is called the *Landrath*.

In each of these sub-districts a district physician (*Kreisphysicus*) is placed at the head of the sanitary administration. He has a surgeon as assistant.

In Germany the district physician is the real chief of the department of public hygiene, as he supervises the carrying out of the necessary measures by the local authority (*Ortspolizei*). His duties are not always the same in different States.

They are generally as follows:—

To approve plans relating to the opening of new cemeteries;

To inspect charitable institutions, hospitals, and prisons;

To control the sale of provisions;

To inspect offensive and dangerous trades;

To examine plans for the construction of new factories;

To superintend the hygiene of schools;

To examine plans for the building of projected schools;

To survey public sewers and works of public health;

To direct and superintend vaccination;

To examine plans for the building of hospitals, etc., and public establishments; also plans prepared for the building of new wards and streets, regulations for erections, etc.

To take suitable measures in case of epidemic.

With regard to infectious diseases, it is also the duty of the District Physician—

1. To inform the local police as to the manner in which each disease spreads, and the early symptoms of the same;

2. To give the same information to the public through the newspapers;

3. To remind the persons who should notify all cases of infectious disease;

4. To inspect inns and lodging-houses with the view of taking measures for preventing the spread of any infectious disease;

5. To overlook prisons and places of detention for the same purpose;

6. To keep watch over the health of workmen employed on railroads or other public works;

7. To inspect charitable establishments;

8. To visit places which are considered unhealthy, and their surroundings, especially any which have previously suffered from epidemic disease;

9. To superintend the sewer service, disinfection of cesspools, manure, etc.;

10. To arrange for a strict inspection as to the carrying out of the regulations for maintaining cleanliness in such trades as tanning, slaughtering, soap-making, etc.;

11. To regulate the disinfection of railway stations, prisons, and hotels;

12. To enforce the regulations relating to the sale of food and drinks;

13. To ascertain that the water delivered from wells and fountains is of good quality;

14. To take measures to prevent the holding of fairs and other assemblages of the same kind, and for the closing of schools;

15. To organise medical attendance;

16. To provide places for the isolation of the sick;

17. To arrange for the removal of sick persons;

18. To select trained nurses;

19. To name persons who might assist the police, and see to the carrying out of the proposed measures;

20. To provide suitable disinfectants, and choose competent disinfectors;

21. To regulate burials, and arrange for convenient mortuaries;

22. To forbid the exposure of corpses after infectious disease, and to prevent any concourse of people at the funeral.

The doctor of each sub-district (*Kreisphysicus*) must send in an annual report. A circular issued in July, 1884, requires that the report should include meteorology, demography, provisions, water supply, means of subsistence, the hygiene of factories and schools, public and private buildings, prisons, asylums, relief board, hospitals, ambulances, the care of the sick, burials, and the staff of the medical services.

Vaccination can only be performed by authorised doctors, there being official vaccinators (*Impfaerzte*) for each sub-district.

The local authorities are free to issue any sanitary regulations they may deem necessary, and disobedience is punishable with a fine.

Sanitary Legislation.—**Foods** (*Nahrungsmittelgesetz*, 14*th May*, 1879. *Kaiserl. Verordnung* 1*st May*, 1882).—The police must be allowed free access to places of sale whenever open. They have the right to demand samples of all provisions exposed for sale or hawked, in shops as well as in markets and public places. Part of each sample with the official stamp may be returned to the seller at his request. If the samples are satisfactory, they are paid for at sale prices.

Adulteration and frauds are punished by fines, which may amount to 1,500 marks, and imprisonment from 6 months to ten years, with the loss of civil rights.

The amount of the fines is determined by the official Board instituted for the analysis of samples.

The use of noxious colours in the preparation of foods is prohibited; nothing of this description must be preserved or packed in envelopes tinted with poisonous colours, nor in vessels made of poisonous substances, which might be communicated to the provisions they enclose.

Inspection of Pork (*Rundverfügung of the 4th January*, 1875).—The federal government has invited all the German States to organise compulsory inspection of pork wherever circumstances demand it, and the inspection can easily be made. This measure has been necessitated by the epidemics of trichinosis which have occurred frequently in Germany, the Germans being extremely fond of ham, raw, or only a little smoked, and half-cooked sausages. The report presented by the Imperial Office of Health, requesting that this inspection should be made compulsory, has not, however, been approved by the government.

Inspection relating to trichinosis has been established in some places in virtue of decrees containing the following regulations :—

Whoever kills a pig must have it examined by an authorised inspector. When this officer has given a certificate attesting that the animal is free from trichinosis, the meat may be cut up and sold. If on the contrary the pig is diseased, the expert must inform the police.

The fat of a pig affected with trichinosis may be given up for use after the meat has been cut into small pieces and cooked for three hours under the superintendence of the inspector. When the fat has been separated, the rest of the meat must be buried in the earth.

The inspection of meat suspected of trichinosis is not valid unless performed by a person specially authorised by the police. This authorisation is given to doctors, apothecaries, and veterinary surgeons when requested.

Other persons who may desire a similar licence must previously submit themselves to a theoretical and practical examination before the District Physician.

No inspector must examine the flesh of more than 6 pigs in one day, and he must keep an exact account of the discharge of his duties.

For meat affected with measles there are only local regulations varying in degree of strictness.

Regulations concerning the Flesh of Tuberculous Animals.—After consulting competent persons, the Judge must decide in each case whether the flesh of a tuberculous animal is to be considered diseased, and its sale punished according to the regulations of the Penal Code (*Strafgesetzbuch*).

The flesh must be considered diseased and noxious when it contains tubercles, or when the animal is emaciated by the disease, though no tuberculous deposit may be discovered.

If the animal is in good condition, and the mischief is confined to one organ, the meat may be used for food.

Inflation of Meat.—All inflation of meat is forbidden, whether bellows are used or only the mouth.

Milk Trade.—(*Rundverfügung of the 28th January*, 1884).—By the

order of the Chancellor, a Commission has been nominated to consider whether a decree could be framed on the basis of the law of 1879, regulating the sale of milk throughout the Empire.

In practice a general law of this kind would present great difficulties, and the arrangements proposed were considered impracticable, excepting for some important cities and special localities.

The Minister then addressed a circular to the local authorities, urging them to establish local regulations wherever the need for them was recognised, these regulations being made applicable to the cow-keepers as well as to the purveyors.

Orders relating to Foods and Drinks.—A circular of the 30th August, 1882, contains regulations intended to prevent the mischief occasioned by the presence of ergot in the corn (*secale cornutum*).

An order of the 30th October, 1882, puts the public on its guard against poisonous fungi, and recommends that mushrooms should be steeped several times in boiling water, and afterwards pressed before eating.

A circular of the 12th August, 1884, comprises instructions as to the methods of testing and analysing wines.

The orders of the 17th February and 29th December, 1880, regulate the apparatus employed in the drawing of beer for sale (*Bierdruckapparate*).

Inspection of Foods.—The general law of the 14th May, 1876, imposes on the State Governments the duty of convincing the public of the utility of laboratories for the analysis of foods. Several circulars were accordingly published representing the importance of such laboratories, and requiring a certain standard of knowledge from the inspectors who should be attached to them. These inspectors must decide on the quality of the foods and their chemical composition, leaving questions as to their wholesomeness to the District Physician or the veterinary surgeon.

Particular instructions must be drawn up for each establishment, and all the transactions must be entered in a special register.

Legislation relating to Manufactories.—Every manufacturer employing workpeople under the age of eighteen years is bound to take all precautions necessary for morality and the preservation of health, and to give employés sufficient time to attend adult schools. In several States attendance on these schools is compulsory, but each locality has the right to make such rules for this purpose as it thinks proper.

Manufacturers are bound to take the necessary measures to secure their workmen against accidents and against the effects of employments injurious to health.

The Federal Council prescribes the regulations to be enforced in factories. If these regulations do not exist in a province, it is incumbent on the local authorities to introduce them.

Children under twelve years are not admitted into manufactories. Up to 14 years the working day must not exceed 6 hours, and the children must be allowed half an hour in the day for rest.

From 14 to 16 the working day is ten hours in length, with an hour's

interval at noon, and half an hour morning and evening. Work must not begin before half-past five in the morning, nor be continued later than half-past eight in the evening.

During the interval for rest the children must not remain in the factory, or only as many as are necessary to present the work from being completely stopped.

The employment of young people on Sundays and fête days is forbidden.

Children employed in factories must attend the primary school at least three hours a day, as their education is not finished.

Every manufacturer who wishes to employ young people must inform the police of the district (*Ortspolizei*) in writing. This declaration must comprise a statement as to the days of work, the time when it begins and ends, the length of the intervals allowed, and the nature of the work to be performed. No change in these arrangements can be made without a new declaration.

In the workshop where young people are employed, a list of names must be conspicuously shown, indicating the number of hours of work for each, and the intervals of rest. The regulations as to the work of children in factories must be put in the same place.

Women and children must not be employed in trades which are dangerous to health. A woman must not return to work for three weeks after her confinement.

To insure the strict observance of these rules, government nominates factory inspectors who must render an account of their work to the Federal Council.

Every breach of the rules is punishable by a fine, which may amount to £75 or six months' imprisonment.

In order to protect the public against nuisances caused by manufactories, a special authorisation is necessary for the opening of these establishments. If the public make no objection to the application, the authorities shall take account of the possible advantages and annoyances before granting the licence. This will not be given until the arrangements for the safety of the workmen are satisfactory. In case of refusal, the reasons will be communicated to the applicants.

If the carrying on of a factory becomes a source of danger or a nuisance, the administration may order it to be closed. In this case the proprietor has a right to compensation.

Law on the Insurance of Workmen against Sickness (*Reichsgesetz betreffend die Krankenversicherung der Arbeiter, June 15th*, 1888).—Every workman engaged for more than a week is obliged to insure against illness, etc., if his daily wages do not exceed 6*s.* 8*d.*

Each Commune may form a district for insurance, having its relief office, or several may have an office in combination. As soon as a workman falls sick he receives medical attendance gratuitously, also medicine, spectacles, trusses, and similar articles if required.

If the patient is absent from work through sickness for more than two

days, he receives half the daily rate of wages usual in that place. This help is not continued longer than thirteen weeks.

The Communes have the power to enact that this assistance will not be given in cases of illness or injuries occasioned by quarrels, drunkenness, or debauchery.

The premiums are paid in advance every week, and must not exceed $1\frac{1}{2}$ per cent. of the wages.

The insurance office is managed gratuitously, and must not be included in the budget for the Commune.

A report of the state of the office must be sent every year to the superior authority. If the resources of the office are insufficient, the deficit may be covered by an advance from the office of the Commune. If it is ascertained by the annual reports that the contributions do not defray the expenses, the premiums may be raised to 2 per cent. on the wages with the sanction of the authorities. If there is any surplus, it goes to form a reserve fund.

If the annual accounts continue to show a surplus, premiums may be reduced or the allowances increased. Failing the adoption of these measures by the Commune, they may be ordered by the superior authority.

When the number of insurances in a Commune falls below fifty, or 2 per cent. on the wages does not cover the expenses, the authorities may associate several Communes together if desired.

Every Commune having more than 10,000 inhabitants, being associated with others having a smaller population, has the right to take the management of the relief office.

Local Office for Relief (*Orts-Krankenkassen*).—The different places in a Commune may each form a benefit society for themselves if the number of compulsory insurances is not less than 100. These offices will be attached to the several branches of industry. Several trades may unite when the number of workmen in each is less than 100.

The trades which only employ a small number of workmen may, however, have their own office, if the local authority approves of its constitution.

These local offices may make different arrangements from those of the Communes; they may continue grants beyond the thirteen weeks; women receive assistance during their confinement; members of the family may obtain medical aid and medicine, etc., gratuitously, and contributions are made towards the cost of funerals. But those funds must not be used for education nor for help in old age.

The deposits are regulated by the needs of the office. Rules must be drawn up by the Commune, and approved by the superior authority.

Members of the Society changing their employment may remain in the Society as long as they continue to pay their contributions, and reside in Germany. If the payment of the premiums is neglected, the right to assistance is forfeited.

A member out of work receives assistance for three weeks.

Each office must create a reserve fund equal in value to the average amount of assistance given per annum.

Arrangements Common to all Relief Offices.—Every employer is bound to inform the office whenever he engages or dismisses a workman, so that the name may be inscribed or taken off the list of contributors.

Whoever neglects this formality takes on himself the obligations of the office, and is liable to a fine of a guinea.

The employer must see that his workmen make their payments in advance. He is bound to pay into the office a sum equal to a third of that paid by the workmen.

The present law does not annul the obligations belonging to the Commune and the Relief Board.

Relief Offices for Manufactories (*Betriebs-* (*Fabrik-*) *Krankenkassen*).—In all factories employing at least fifty workmen, a relief office may be established for cases of sickness, and if the Commune requires it, the owner of the factory may be compelled to found one.

The same obligation may be imposed on factories where the work is dangerous, even though less than fifty workmen are employed.

Permission to form a small office may also be given to a small factory, if suitable guarantees are offered for the maintenance of the office.

The proprietor of a factory who shall have neglected to form a relief office within a fixed time, will be liable to pay to the communal or local offices a sum equal to half the wages of his workmen.

The payments to the relief office for factories are made by the employer, who is bound to contribute a third of the sum paid by the workmen. In cases where 3 per cent. on the wages will not suffice for the maintenance of the office, the difference must be made up by the employer.

Relief Office for Workmen Employed in Buildings (*Baukrankenkassen*).—Builders who employ from time to time a great number of workmen are bound to form relief offices for their convenience. Any employer failing in this obligation will be compelled himself to pay the expenses imposed by this law when a case of need occurs.

Relief Office for Artisans, etc. (*Innungs-Krankenkassen*, *Knappschaftskassen*).—Workmen who belong to a Relief Office for Artisans, or any similar society, need not contribute to the different offices above-named, always providing that the advantages offered by their own society are at least as considerable as those of the other offices.

Law relating to Insurance against Accidents (*Unfallversicherungsgesetz*, *6th July*, 1884).—This law completes the legislation for insurance against sickness, but the regulations which it comprises are only applicable after the expiration of the thirteen weeks during which grants are made by the relief office to those entitled to them.

In the event of accidents, a life annuity is given, which may rise to two-thirds of the workman's annual income, if he is quite incapacitated for work; in the event of partial incapacity, the grants are regulated so as

to provide the necessaries of life according to the degree in which the sufferer is invalided. In the event of death, the expenses of burial are paid, and the survivors are entitled to a pension. A widow receives 20 per cent. of the annual income of the deceased, and each child 15 per cent., but the total grant must not exceed 60 per cent. of the workman's wages.

Parents, whether by birth or adoption, receive 20 per cent. of the annual income of the deceased if he was unmarried. The insurance is secured by mutual engagements contracted by trade guilds (*Berufsgenossenschaften*) established in certain defined districts.

Employers are bound to announce their participation in the insurance within the time fixed by the Imperial Bureau of Insurance, and to state the average number of workmen they employ in the year.

The authorities of the district must prepare a list of the trades existing in their jurisdiction, and of the workmen employed. This list is sent to the Imperial Bureau of Insurance.

When a society for insurance is not voluntarily formed, the Federal Council invites employers to establish one by mutual agreement.

Trades are divided into classes according to the gravity of the risks incurred by the workmen, and the amount of the contributions is regulated according to this classification.

Precautions against Accidents and Control of the Work of Factories in the interest of Insurance Societies.—A group of insurance societies (*Genossenschaft*) has the right to adopt suitable precautions against the dangers of work in factories. If these measures are not carried out, the factory must be put into a class where higher payments are imposed.

A careless workman is liable to a fine of 6 marks, which is given to the relief office for the sick.

All grants must be sanctioned by the general Imperial Bureau of Insurance.

All the members of a mutual insurance society are authorized to select persons to see that the measures recommended are carried out.

Imperial Bureau of Insurance (*Reichs-Versicherungsamt*).—The control of the laws for insurance societies is exercised by the general Imperial Bureau of Insurance at Berlin. It is composed of a Committee of three members, appointed for life by the Emperor on the nomination of the Federal Council, and of eight temporary members. Four of these are chosen by the members of the Federal Council, and the other four by the presidents of the groups of insurance societies. Two of the last are nominated by the workmen in their respective groups.

The other functionaries of the Bureau are appointed by the Chancellor.

All complaints and objections relating to this law are submitted to the decision of the general Bureau of Insurance Societies, which is also charged with the duty of inspecting the operations and accounts of all the groups of insurance societies. The costs for maintenance of the insurance service form an imperial charge.

Vaccination (*Reichs-Impfgesetz, April 8th*, 1874.)—This law is in force in all the German States. Every child must be vaccinated in the year which follows that of its birth, unless the doctor certifies that it has already had small-pox.

All pupils of public or private schools, Sunday schools and evening schools excepted, must be re-vaccinated in their twelfth year, unless they have had small-pox, or have been successfully vaccinated within five years.

When a doctor certifies that a sick child cannot be vaccinated without danger to life or health, the operation must be performed in the course of the following year. If the illness continues, the vaccinator must himself decide when the operation should be performed.

If the first vaccination should not succeed, it must be attempted a year later, and if still unsuccessful, a third time.

When the vaccination of children has been neglected, the operation must be performed within a time fixed by the local authorities.

All vaccinated persons must present themselves for examination not earlier than the sixth day, or later than the eighth day after the operation.

Districts for vaccination, each having a doctor, must be formed in every town.

Vaccination is gratuitous, and is performed in the months of May or September at the times and places fixed by the doctor. The places for vaccination and inspection must be within five kilomètres of each other.

A list of persons to be vaccinated must be supplied to the doctor by the authorities, and the doctor will prepare lists of successful vaccinations, and forward them to the authorities.

Only doctors are authorized to perform vaccination.

It is incumbent on the governments of the different States to establish depôts for the vaccine required for the observance of the regulations of the Federal Council.

These depôts supply the vaccine gratuitously, the quantity received and given out being registered.

Public vaccinators are obliged to furnish as much vaccine as their supply permits.

After examination the person vaccinated will receive a certificate, on which is written the name and age, and the result of the operation, and that it must be performed again in cases in which this is necessary.

The certificate must be presented as often as the authorities require it, or when the child seeks admission into a school.

Directions concerning Vaccination.—If an infectious disease shows itself in a place, whether scarlet fever, measles, diphtheria, whooping cough, spotted typhus, or erysipelas, vaccination is forbidden until after its disappearance.

When the periods for vaccination are fixed, and the public is informed of them, private directions for the care of vaccinated persons are issued.

Before vaccine is taken from a child, the latter must be examined when quite naked, in order to ascertain that it is perfectly sound and healthy. It must be the child of parents free from hereditary disease, must be legitimate, not the first child of the family, and above all, must not be the child of a woman who has had several miscarriages.

The child from whom vaccine is to be taken must be at least six months old, and must not have any sores, eruptions, or glandular swellings, nor bear traces of any chronic affection of the nose, eyes or ears.

It must not have rachitic limbs.

The vaccine used must be free from blood or pus, and flow from the vesicle spontaneously after incision. Vaccine too liquid or of bad odour must not be used.

The glycerine added to the vaccine must be perfectly pure, and the mixture must be made with an absolutely clean glass rod, sterilized by heat.

Children under three months must not be vaccinated, nor any suffering from acute or chronic disease, or bad nutrition. The doctor may set aside this regulation if there is an epidemic of small-pox.

The lancet for vaccination must be perfectly clean, washed and dried after every operation, not with linen, but with carbolic or salicylic cotton. Pure water or glycerine is used for diluting the vaccine. It is forbidden to apply the vaccine with a brush.

The vaccination is considered satisfactory if two pustules are well developed. If there is only one, the operation is renewed with the vaccine which comes from it, and the certificate of vaccination may be given. In cases of re-vaccination it is considered satisfactory if small pustules form on the skin.

Children must not be taken to the place for vaccination from any house where there is infectious disease, but such children must be vaccinated and examined separately.

Before children are taken to be vaccinated, they must be bathed and properly clothed. Any who are dirty will be sent back by the person in charge of the place.

The place for vaccination must be clean, well lighted, and ventilated. No crowding is allowed in the room.

Laws for the Prevention of Infectious Diseases (*Regulativ der* 8 *August*, 1825; *Gesetz über allgemeine Landesverwaltung der* 21 *März*, 1850; *und der* 20 *September*, 1867).

General Regulations.—Commissions of public hygiene are established for the prevention and treatment of infectious diseases. In towns having more than 5,000 inhabitants these Commissions are made compulsory. In smaller places, and in the country, the matter is left to the government.

These Commissions are composed of: the head of the police, who is president by right; the president of the Municipal Council; one or more doctors nominated by the police; three men chosen among the delegates

from the town; in garrison towns, one or more officers nominated by the commandant, and lastly, a military doctor of the first class.

In very populous towns the police decide whether it is needful to name sub-commissions in addition, comprising at least one doctor or surgeon, an official of the police or the municipality, and several members chosen by the Commune.

All these Commissions are partly consultative, partly executive. The police must be assured that a meeting will be held whenever summoned, and they are bound to take the proposals of the Commission into consideration.

The functions of the Commission are :

To watch over the sanitary condition of the town and district.

To remove, as far as possible, all cases which might originate or propagate epidemics, such as dirt in general, overcrowded and unhealthy houses, impure air, unwholesome food.

To enlighten the public as to the principal infectious diseases, and the best means of protection against them.

To organize establishments for the sick in case an epidemic is threatened.

To assist the police in all measures taken to hinder its spread.

The Commune must provide for expenses; if any reluctance should be shown, the superior authorities are to be informed, but necessary measures must not be delayed.

In urgent cases the Commission must meet as often as needful, and inform the authorities as to the sanitary condition of the place, and the measures taken once a week.

Notification of Infectious Diseases, and Measures to be taken.—Every father of a family, occupier, hotel-keeper, doctor or clergyman, is bound to inform the police of any cases of infectious disease which might endanger the public health; also of all cases of suspected illness or death. In the latter case the burial cannot take place without the permission of the police.

At the first notification of a case of suspected disease, the police must have the patient examined by a doctor. If the latter ascertains that the illness is of a dangerous character, the administration and the military authority of the place must be informed without delay.

If the number of the sick increases, the communal authorities of the neighbouring districts should be warned.

During the prevalence of any epidemic, one member of the Commission of Hygiene must always be in attendance at the office, and is authorized to take necessary measures at once in urgent cases.

The police must keep a journal in which every case of illness is registered; the name of the patient, his age, religion, profession, or occupation, his dwelling, the day on which the illness began, the probable cause of it, the place where he was nursed, the name of the person who nursed him, lastly the day of recovery or death.

In addition, a report is sent to the government of the province every day and every week concerning the patients under treatment, cures and deaths, with a meteorological summary.

Statistics of Diseases.—Circulars of the 13th January and 23rd May, 1881, oblige doctors to collect information on the statistics of infectious diseases.

For this purpose the medical counsellor of each department sends to the Imperial Bureau of Hygiene a list of all the cases of cholera, small-pox, typhoid fever, eruptive typhus fever, measles, scarlet fever, diphtheria, and puerperal fever, which have occurred in the district under his jurisdiction. This list must be sent on a post card according to the following form :—

Side for the Address.

German Imperial Post.

Post Card.

To the Imperial Bureau of Hygiene,
(Kaiserliche Gesundheitsamt),
In Berlin,
N.W.

On the Imperial Service.
(Name or official seal.)

Opposite side.

District
Year 189.....
Week of the year From.....to.....189.....

Diseases.	Cases.	Deaths.
Cholera		
Small Pox		
Typhoid Fever		
Spotted Typhus		
Measles		
Scarlatina		
Diphtheria		
Puerperal Fever		

Observations.....
District Medical Officer.....

If no case of infectious disease occur during the week, the word *"vacat"* is written.

Supplementary Regulations.—The police must prevent assemblies of all kinds during the prevalence of epidemics, and if circumstances make it necessary, they may close places of public entertainment or re-union, with the exception of churches.

They may also put off the weekly market, or order various changes to lessen the danger of infection.

Annual fairs can only be suppressed by the Governor of the province, and the great fairs (*Messen*) by the Ministry which regulates them.

The closing of schools is regulated by special arrangements which will be cited hereafter.

Military or other travellers attacked with infectious disease must not be billeted on townsmen if it is possible to provide for them otherwise. It is also forbidden to lodge healthy persons in a house where there is infectious disease.

Conscripts who are directed to different bodies of troops must be examined on their arrival, as well as at their departure. The sick must be separated from the healthy.

If while on the march they have passed through places where cholera, typhus, or dysentery are epidemic, the conscripts must be carefully disinfected on their arrival with all their possessions.

Foreigners ill of infectious disease must be sent back with all necessary precautions if the journey can be made without endangering life, and the distance to the frontier does not exceed 35 kilomètres.

This regulation is not enforced if there is a special establishment for the treatment of sick persons in the place.

The medical attendant must decide whether a patient should be nursed at home or removed to the hospital. He must take account of the nature of the dwelling, the character of the illness, distance from the hospital, etc.

In general, however, a patient must not be taken away from home without the consent of the head of the family, but in exceptional cases he may be removed by an order of the police, or the Committee of Hygiene for the district.

The removal of a person suffering from infectious disease from one private house to another, is forbidden without the sanction of the police, who must make the necessary arrangements for preventing the spread of the infection.

When a patient suffering from infectious disease is nursed at home, the doctor must see that the sanitary regulations are rigorously followed, and the police must superintend their execution.

Regulations for the Organization of Hospitals for Infectious Diseases.—A.—The building must be isolated and situated in an open space, if possible away from inhabited quarters, but at such a distance that the patients may be taken to it without difficulty or distress.

B.—There must be no communication between the hospital and its surroundings, and, where necessary, complete isolation must be established.

C.—The beds must be separated by at least 75 to 90 centimètres, and each patient must be allowed 14 cubic mètres of space.[1]

Convalescents are placed by themselves. Hospitals must be provided

[1] This regulation was made in 1835. In England, 52 cubic mètres are required.

with spare wards, so that the wards occupied may be vacated from time to time and carefully purified.

D.—The air of the hospital must be kept fresh and pure. The furniture must be kept perfectly clean, as well as the rooms.

E.—The clothing of the patients must be separately stored and carefully disinfected before it is returned to them.

F.—Convalescents must be isolated until they leave the hospital.

Measures for Isolation.—Persons suffering from infectious diseases should be separated from the healthy. Where isolation cannot be applied to the whole house or storey, it should be secured by means of a room having a separate entrance; and persons having charge of the patient must abstain from all contact with the other inhabitants of the house.

In grave cases the police may prevent all communication between a house and the neighbourhood, in virtue of an order of the 13th November, 1883.

When isolation cannot be carried out, the police should hang a black tablet with the name of the disease written on it in a conspicuous place on the house. This must not be taken away, nor the isolation broken until after the doctor has certified that all danger of infection has disappeared.

Patients suffering from infectious disease of a less serious character, are merely warned to avoid direct contact with strangers, and to keep away from public places.

Disinfection.—As soon as the patient has been removed to the hospital, and after his recovery or death, if he has been nursed at home, all his possessions must be purified, according to the special regulations for epidemics.

The invalid, and all persons who have been in attendance on him, must be disinfected with the greatest care.

Establishments for disinfection should be opened wherever possible; they should be placed under the superintendence of an agent of the police, with a competent assistant.

Articles which have been in contact with a person suffering from an infectious disease must not be used for any purpose, nor taken away until they have been disinfected according to the regulations.

The importation of bedding or linen from a country in which epidemic disease prevails is forbidden.

The body of a person who has died in his own house of infectious disease must be placed in an isolated room, and the regulations respecting disinfection observed until the funeral, which will take place at the end of the time indicated by the law, unless the doctor should certify that immediate burial is necessary.

The coffin must be water-tight, and the grave at least 1·80 mètres in depth.

Persons who have assisted in laying out the body, placing it in the coffin and all who have come in contact with the corpse in any way whatever, must submit to disinfection.

Persons attending the funeral must not meet in the house where the death has taken place.

Regulations concerning Infectious Diseases in Schools. (*Rundverfügung July 14th*, 1884).—I. The following diseases necessitate special regulations for schools, because of their infectious character :—

(*a*) Cholera, dysentery, measles, scarlet fever, diphtheria, small-pox, eruptive typhus fever, remittent fevers.

(*b*) Typhoid fever, contagious ophthalmia, scabies, and whooping cough, as long as it is accompanied with a spasmodic cough.

II. Children suffering from any of the diseases mentioned above must not attend school.

III. The same rule must be applied to children in good health, if one in the family is ill of any of the diseases named in Article I., or unless there is a medical certificate stating that the child is sufficiently isolated and out of danger of infection.

IV. Under the circumstances provided for by Articles II. and III., children must be kept from school until the doctor has certified that there is no danger of infection, or until the period of infectiousness has been completed. The normal period for scarlet fever and small-pox is reckoned at six weeks, for measles and rötheln, four weeks. Before the child returns to school its clothing must be carefully disinfected.

V. The master of the school is responsible for the strict observance of the rules under Articles II. and IV. Every time that a child is absent from school because of infectious disease the local police must be informed.

VI. When a case of infectious disease occurs in a boarding school, no pupil is permitted to return home during the illness, nor immediately after recovery, unless the doctor is of opinion that the removal involves no risk of carrying infection, and all the details of disinfection have been carried out.

VII. When any person residing in the school, or living elsewhere, but belonging to the school is attacked by any of the diseases enumerated in Article I., the committee of the school and the local police must be informed without delay.

The police, with the help of the doctor, must isolate the patient as far as possible, and inform the Mayor of the district (*Amthauptmann*) of the state of affairs and the measures taken.

The Mayor will consult with the doctor, and afterwards decide whether the school ought to be closed, and what arrangements are necessary under the circumstances.

VIII. When a disease breaks out in the neighbourhood of a school, the masters and the committee must keep the building and its annexa in a state of perfect order and cleanliness ; must see that the class-rooms, etc., are carefully ventilated ; and must have the class-rooms, latrines, etc., washed every day. These duties must not be performed by the pupils in the school.

The air in the class-rooms must be renewed in the intervals of lessons, and in the studies and dormitories as soon as the pupils leave them. The water-closets must be regularly disinfected.

These regulations also apply to the apartments mentioned in Article VI.

IX. The closing of an entire school or certain classes is effected by a decision of the Mayor acting in concert with the doctor of the district. In urgent cases the committee of the school, with the advice of a doctor, may decide the question, on condition that the superior authority is at once informed of it.

X. The school or class-room must not be re-opened until the premises have been thoroughly cleansed and disinfected. The Mayor, under the advice of the doctor, will decide as to the time for re-opening.

XI. The regulations included in Articles I. to X. are also applicable to private schools and institutions.

Syphilis (*Regulation 8th August*, 1835; *Minist. Verfügung 1st April*, 1884).—The following are the regulations respecting syphilis:—

If the doctor judges that concealment of the disease might have mischievous consequences to the patient or the public, the police must be informed. Civil doctors who treat soldiers affected with syphilis, are bound to inform the commandant or the chief military doctor.

Doctors, especially hospital doctors, must obtain information from the patient as to the origin of the disease, in order that persons unprovided with the means of subsistence, who would do nothing towards their own care, may be submitted to inspection and subsequent treatment. The same obligation is imposed on military doctors.

In virtue of the law of the 11th March, 1850, periodical inspection is established in large towns for women who live by vice, and girls of loose morals, who have already been treated for syphilis.

Hospitals (*Minist. Verfügung 11th April*, 1886; *Runderlass 3rd April*, 1883).—All hospitals are placed under the superintendence of the State, and must be visited every year by the district doctor, who will prepare an official report containing particulars on—

The situation and character of the hospital buildings;

The quality of the drinking water;

The sewers, the latrines, and their distance from the water supply;

The arrangement of the stairs, vestibules, and corridors:

The number of the wards and their arrangement, specifying whether there are separate wards for small-pox, scabies, syphilis and insanity:

Heating and ventilation;

The quality of the air in the wards;

The floors, doors, and windows;

The size, materials, and arrangement of the beds;

Washing arrangements;

Lighting;

Rooms appropriated to the staff and the nurses;

The latrines placed within the building itself;

The rooms containing linen and clothes; the purification of linen;
The rooms employed for domestic purposes;
Food, kitchen and laundry;
The mortuary.

When cholera, typhus fever, remittent fever, dysentery, if of a serious character, or scarlet fever break out in a hospital, the superintendent must immediately inform the police.

Where there are no separate buildings for infectious diseases the best arrangements for isolation practicable must be made at once.

If small-pox should break out in a hospital where there is no special ward for the disease, the other patients must be re-vaccinated on the spot.

Similar measures should be taken for other infectious diseases. A thorough disinfection must be made after the termination of every case.

Corpses and Burials (*Rundverfügung 21st November*, 1801; *Verordnung 27th June*, 1845).—Corpses must not be exposed in the churches. It is the duty of the authorities to establish convenient mortuaries. Midwives are forbidden to wash or lay out corpses.

The bodies of persons who have died of infectious diseases must not be exposed (*vide* above), and bodies must not be removed from a place where an epidemic is raging. For removal, bodies must be put in a coffin perfectly closed and encased in a shell impervious to air. There must also be a certificate from the district doctor stating that the removal will not be dangerous from the sanitary standpoint.

The bodies of persons who have died of cholera must in no case be removed from one place to another. The interment must take place within 48 hours after death.

Cemeteries.—There is no general law concerning cemeteries, but hygienists have made certain regulations. A cemetery must be at least 200 mètres distant from inhabited houses. No springs for drinking water are allowable on the land, and there must be no well within a distance of 200 mètres.

The position of the subsoil-water in the neighbourhood of the proposed cemetery at a higher and lower level than the chosen site, should be examined, to ensure that there is no possibility of the subsoil-water finding its way into any stream.

Protection of Children of Tender Age (*Rundverfügung 18th July*, 1874; *Minist. Verfügung 25th August*, 1880).—All persons receiving payment for taking charge of children are placed under the superintendence of the police, and are bound to inform them of the arrival of each child.

It is the duty of each commune to make regulations for the well-being of such children, paying attention to the following particulars:—

I. Persons who wish to undertake the care of children under six years old for payment must obtain permission from the police.

II. This permission will only be given to persons living in a respectable manner and occupying suitable premises.

III. Each time the dwelling is changed permission must be renewed.

IV. If a child is neglected, or the person having charge of it falls into bad circumstances, the permission is withdrawn.

V. The police or some person nominated must have free access to the children in order to obtain precise information as to their condition.

VI. The arrival and departure of each child must be notified to the police.

VII. The declarations must mention the name of the child, the place and day of its birth, the name and residence of its parents; if the child is illegitimate, the name and address of the mother and of the guardian.

VIII. Infractions of these rules are punishable by a fine of 28 marks or by imprisonment.

Kindergartens and Infant Schools (*Kleinkinder Bewahranstalten*). —Kindergartens and infant schools are placed under the superintendence of the school committees of the districts.

Special permission is necessary for the opening of establishments of this nature, which will only be given to persons of good character, married or widows, who have spacious and healthy premises at their disposal.

Contamination of Streams.—There are no regulations in Germany relating to the contamination of rivers and streams, but the attempts made by towns to bring sewage into the neighbouring rivers have hitherto been defeated by Government authorities.

On these questions as well as on the drainage of the towns the scientific deputation for medical affairs (*die wissenschaftliche Deputation für das Medicinalwesen*) has drawn up an extended report which has not yet been followed by legislation. It is still the duty of the minister to decide in each particular case.

Measures to be taken in case of Inundations (*Ministerialverfügung 1st January*, 1883).—This decree recommends tenants not to return to houses which have been flooded until they have been thoroughly dried, cleaned and disinfected.

The floors ought also to be relaid and the privies carefully examined lest leakage should have taken place.

Measures relating to Buildings.—There are no general regulations for buildings for all the Empire, the duty of establishing such regulations being left to each place.

A decree of the 15th February, 1882, in force throughout Prussia requires that houses provided with heating apparatus (*Luftheissung*) must have the pipes and chambers of hot air cleaned with wet linen cloths at fixed intervals of 4 weeks.

The use of dampers for the chimneys and stoves is forbidden; doors hermetically closed are substituted. Bavaria alone, among the German States, has issued general regulations for buildings, which include the following:—

When a town or village is to be built in whole or in part, the plans must show the elevation of the ground, the condition of subsoil water, and the slope of the ground with a view to drainage.

The ground on which it is proposed to erect new buildings must fulfil the conditions required by public hygiene or at least be put in such a state as to satisfy them. Permission must be obtained from the Commission for Buildings for the building of new houses, digging wells or cellars, making sewers, drainage, privies or cesspools. The same permission is necessary for alterations.

Chimneys, discharge-pipes, or pipes for the ventilation of latrines, etc., must be constructed in such a way as not to cause a nuisance to neighbours or endanger the public health.

Houses must not be higher than the width of the street; in any case they must not exceed 22 mètres in height nor have more than five storeys including attics. The floor of inhabited rooms must be at least 0·30 mètres above the level of the ground. This limit may be reduced or increased if the Commission recognises the necessity for this arising from the nature of the ground. Sometimes the floor must be raised above the earth by a bed of concrete. In such a case the Commission can insist on special arrangements for ventilation.

Alleys or cul-de-sacs between buildings should be avoided; where they do exist they must not be used for privies or for the reception of waste-water. All houses must have yards corresponding to the height of the building. Pits for manure and cesspools must be at least 1 mètre distant from houses and so arranged that no overflow can come near the house.

Inhabited rooms must be at least 2·75 mètres in height, in towns of more than 7,000 inhabitants, and 2·60 mètres where the population is smaller. Every room, kitchen, or water-closet must have at least one window with direct ventilation.

Buildings are not allowed to be lime-washed in pure white or glaring colours.

These rules may be set aside in small places having no local regulations for buildings, and in the country, if the Commission does not object. But the minimum of height admissible is 2·40 mètres and each room must have a window.

The medical authorities must be consulted in all questions relating to hygiene.

CHAPTER II.

BERLIN.

General Remarks.—Sanitary Administration.—Bureau of Statistics.—Regulations for Buildings.—Hotels and Shops for the Sale of Drinks.—Lodging Houses.—Sanitary Arrangements relating to Air.—Sanitary Arrangements relating to Water.—Foods.—Superintendence of the Sale of Foods.—Inspection of Meat.—Markets.—Milk Trade.—Public Kitchens.—Sanitary Arrangements relating to the Ground.—Flushing of Sewers.—System of Latrines.—Drainage.—Sewage Farms.—Stables, etc.—Markets for Cattle and Abattoirs.—Preventive Measures against Infectious Diseases.—Vaccination.—Hospitals for Isolation.—Disinfection.—Mortuaries.—Cemeteries.—Prostitution.—Public Buildings.—Dwellings for Workmen.—Hygiene of Factories.—Hygiene of Schools.

General Remarks.—The city of Berlin, situated in the northern plain of Germany on the banks of the Spree, covers a surface of rather more than 60 square kilomètres. The land is uniformly flat and the level only 30 mètres above the sea. The population of the city has increased rapidly in the course of the last 20 years. It was 700,000 in 1870, but is at present 1,400,000.

Extensive sanitary works have been executed in the interests of the public health, the city having thus justified its title to be the capital of the new German Empire. Exemplary order and discipline are seen in all branches of the administration, apparently forming part of the national character, but strengthened by the military spirit which recent events have impressed on the whole people.

In all that concerns the public health Berlin has taken London for a model; and as the hygienic institutions of England are incontestably the most perfect, those of Berlin may also be placed in the first rank.

The rate of mortality is very high in Berlin, as in all German cities, the average for the ten years 1881–90 having been 23·8 for 1,000 inhabitants. It is principally kept up by the abnormal number of deaths during the first year of infancy which is 24 per 1,000 for legitimate children and 52 for illegitimate, making a mean of 38 per 1000. The good effects produced by recent hygienic works are clearly shown in the diminution of typhoid fever.

The average number of deaths from this disease per 10,000 inhabitants is as follows:

From 1870 to 1874	9·7
From 1875 to 1879	5·4
From 1880 to 1884	2·9
From 1885 to 1889	1·6
From 1890 to 1891	0·9

Sanitary Administration.—The city of Berlin is administered by a separate government (*Regierung*), which forms part of the province of Brandenburg. The head of the city government is also the Prefect of Police (*Polizeipräsident*); associated with him is a medical councillor (*Regierungs-Medicinalrath*), with his assistant (*Hülfsarbeiter*), who direct sanitary and medical affairs.

Like other governments, the city of Berlin is divided into districts (*Hauptmannschaften*), of which there are ten, each having its head of police (*Polizei-Hauptmann*) and its own doctor (*Kreisphysicus*) charged with the sanitary administration of the district.

The doctors for the districts meet once a month under the presidency of the medical councillor of the government to deliberate on questions relating to hygiene and the care of the sick.

The officials who are at the head of affairs are invested with State authority.. The communal authorities, burgomasters, aldermen, and the Municipal Council are responsible for carrying the orders of the medical officers into execution. Commissions nominated by the city authorities have the care of the public health. One is specially charged with the oversight of hospitals and asylums, the other attends to the public works (*Baudeputation*), etc.

According to the regulations for epidemics (*Regulativ von* 1835), a commission of public hygiene (Sanitas-Kommission) is established for the whole of the city, with local commissions for the different districts, forming altogether the consultative authority on all questions relating to the public health. Their authority and functions are the same in Berlin as in the rest of the country.

Bureau of Statistics.—Since the year 1872 Berlin has possessed a statistical administration, which also keeps registers for the police service. The duties of this office are as follows :—

I. The enumeration of the population under the following heads: social position, means of subsistence, dwelling and occupation of each inhabitant.

II. Births and deaths.

III. Emigration and immigration.

IV. Statistics of disease among the poor, and in the establishments of the Relief Board, also statistics of infectious diseases based on compulsory notification, and cases of diseases and deaths in the associations of working men.

V. Statistics of the Relief Board.

VI. The recording of meteorological and hydrometrical observations.

VII. Statistics of factories (wages, etc.), schools, etc. The office is also charged with the collection of information relating to social economy in all its details.

Regulations for Buildings (*Bau-Polizei-Ordnung der* 21 *December*, 1886).—Two-thirds of sites recently acquired may be covered with buildings; in older sites three-quarters of the surface may be covered.

Buildings raised on the same site must be separated by yards at least 60 square mètres in extent and 6 in breadth. The width of houses must not exceed 18 mètres.

Their height must not exceed the width of the street, and in no case be greater than 22 mètres. If the house abuts on two streets of unequal width, its height should not exceed the mean of the width of these two. Houses erected within an enclosure must not be more than 6 mètres higher than the width of the yard. Receptacles for refuse must be impervious to moisture and be furnished with a tightly fitting cover. Refuse-water must be carried off by water-tight pipes, and excremental matter must be carried into the sewer or into movable pails.

The place where the tubs are deposited must be hermetically closed and have a water-tight floor.

Floors of stables must also be impervious to moisture, and the manure collected into water-tight cesspits; the doors must not open in the street.

All buildings must be supplied with plenty of drinking water. Pipes by which refuse is carried off must be prolonged upwards to the top of the roof in order to ensure sufficient ventilation. In order to obtain permission to build, application must be made to the police, who will give it, after inspecting the site. A new inspection must be made when the walls are built; the time is then fixed when plastering may be begun. A dwelling-house must not be plastered until six weeks after the completion of the masonry.

No house must have more than five storeys. All rooms intended for habitation must be dry, and have good sized windows, opening either in the street or on a yard of the specified dimensions.

In rooms, which must be lighted from above, the use of sashes is permitted on condition that good arrangements are made for ventilation.

Rooms for habitation must be at least 2·50 mètres in height, and never be more than 0·50 mètres below the ground-level.

It is forbidden to build underground rooms on the side of the house adjoining the yards, if the width of the latter is less than the height of the neighbouring houses.

The floors of rooms must be at least 0·40 mètres above the highest level of the subsoil-water and be protected from ground-air and ground-water by means of some impervious material.

Walls of underground rooms must be covered with impervious material.

Water-closets and bath-rooms must receive air and light either from the street, the entrance-yard, or an open passage of at least 10 square mètres in dimensions, and 2 mètres in width; water-closets must not be placed beneath inhabited rooms. Passages and corridors which do not communicate with the extreme air by windows must be furnished with ventilating-pipes having a diameter of not less than 250 square centimètres. These regulations must also be applied to houses already built whenever it is considered necessary for the public well-being.

Hotelsand Shops for the Sale of Drinks (*Polizei-Verordnung* 30 *Januar*, 1880). — Inns and shops for the sale of drinks must be situated in a street quite finished and well lighted ; distant from houses of ill fame ; they must be well ventilated and protected from damp.

The bedrooms must be of good size, the house have an abundant supply of water, and be provided with a sufficient number of urinals placed at a distance and well ventilated.

Lodging Houses (*Polizei-Verordnung* 17 *December*, 1880). — I. No person must receive lodgers for the night in his own dwelling, unless the rooms let fulfil the following conditions :—

(*a*) Each person must have at least 3 square mètres of space for his own use, and 10 cubic mètres of air. The quantity of air may be reduced to one-half for children under six years, and to two-thirds for children between six and fourteen.

(*b*) The rooms must not be in direct communication with water-closets.

II. The sexes must be lodged in separate rooms.

III. Any one letting nightly lodgings to strangers must inform the police within six days, by sending a report drawn up according to the following formula :—

The undersigned lets in his dwelling, No..... road.....story.....beds.....for the night to.....men and women.

His own family consists of.....persons, of whom.....are boys and.....girls, below six years of age ;.....boys and.....girls from six to fourteen years of age, and .....other persons,.....men and.....women.

The bedrooms have the following dimensions :—

No. 1. Length.....Breadth.....Height.....
No. 2. „ ..... „ ..... „ .....
No. 3. „ ..... „ ..... „ .....

The place and date..... The name and occupation of Proprietor .....

These particulars are verified by the police, who then give a licence to receive the number of persons permitted by the law.

The same conditions concerning space and air are imposed on those who lodge homeless persons for the night (in places named *Pennen*) ; but in addition it is prescribed that every person must have a separate bed with pillow, palliasse, and woollen covering, if the room is not warmed to the temperature of 12° C. The bedding must be washed, and the straw renewed once a month.

Every room must be supplied with a washstand, clean night-vessels, and drinking-water.

The rooms must be aired from 9 to 11 a.m. and from 2 to 4 p.m., swept every day, and washed once a week, as well as the water-closets.

The ceiling and walls must be lime-washed once in six months.

Every case of illness accompanied by fever must be immediately notified to the police.

Sanitary Arrangements relating to Air.—The city of Berlin does not possess parks of any extent within its boundaries, but the *Thier-*

garten, surrounded by newly built quarters, forms a valuable reservoir of air for the city.

It covers an area of 250 hectares. The principal street of the city, *Unter den Linden*, terminates in it. This street is planted with trees throughout its length.

Small gardens have been laid out wherever it was possible, especially in the vicinity of churches, where old quarters of the town have been improved, and at places where several streets meet.

In recent years fifty public places have been planted with trees, having altogether an extent of 30 hectares.

The old market-places now superseded by covered markets, have also been planted with trees.

Large parks have been made on suitable land outside the city, the *Humboldthain* on the north containing 35 hectares, the *Friedrichshain* to the north-east 52 hectares ; that of *Treptow* to the south-east, 90 hectares, and the little *Thiergarten* to the north-west containing only six and a half hectares.

German houses are well ventilated. Fresh air is liberally supplied, the old dread of chills having disappeared. This remark applies to the ventilation of hospitals, schools, and other public buildings, as well as to private houses.

With respect to hospitals there is a general tendency to get rid of the complicated arrangements for central heating and ventilation, which were in vogue for some years.

As in England, dearly bought experience has shown that these complicated apparatus are of little use unless managed by able men, while they are liable to derangements which are often dangerous.

In Germany there is an apparatus for heating known by the name of *Mantelofen* (stove with jacket). At one time it was only used in private houses, but its merits have now become so generally recognised that it is introduced into schools and even into hospitals (*Tempelhof*, *Bethanien*) in Berlin.

Although the construction differs from that of the English ventilating stoves (made by Douglas Galton and Boyle & Son, pp. 64 and 100), the idea is nevertheless the same, namely, that the outside air, being brought into contact with the stove, is warmed as it enters the rooms.

The stove itself is of cast-iron surrounded with a casing of sheet-iron and earthenware enclosing an air chamber. Towards the bottom between the casing and the stove is the opening for the supply-pipe, which brings the external air into the chamber. There are also openings in the lower part of the casing to the inside of the room. They can all be closed by keys. The casing is surmounted by a grating.

When it is merely required to warm the air of a room, the pipe leading to the extenal air remains closed and the key at the side of the chamber is opened. The cold air above the floor falls towards the lower part of the casing and returns heated at the top. This circulation warms the room quickly.

When it is desired to renew the air completely, the supply-pipe is opened and the opening at the side of the chamber shut. The vitiated air then escapes by pipes, which are so arranged as to be heated by the smoke flues of the stove.

In a short time the air of the room is renewed without any inconvenience or lowering of the temperature.

If it is unnecessary to renew the air of the room quickly, the use of the open-air pipes may be dispensed with. Part of the vitiated air then escapes by the stove and assists combustion. The pressure occasioned by the entrance of the heated air drives another part of the vitiated air through the interstices of the windows and doors; a current of warm effluent air is thus produced, while by the ordinary methods of heating cold air penetrated into the room.

The air in other rooms may be warmed by the same stove if they are connected by pipes with the casing. Each of these pipes is furnished with a valve, so as to form a central system of heating on a small scale.

The advantages of this mode of heating and ventilating are evident: the fittings are simple and inexpensive; each room may be warmed and ventilated independently of the others; it cannot get out of order, and no special knowledge is required for its management.

The casing preserves the room from excessive heat caused by radiation.

The most simple apparatus of the preceding kind is the *Meidinger's Stove*, which is composed of a cylinder shut by a lid on which the fuel is placed; the pipe which serves for the escape of the smoke is high up on one side, the grating is below; coke is the fuel employed. This stove was constructed by Professor Meidinger, for the expedition of Koldewey to the North Pole, where it rendered excellent service. It was made at the factory of Kaiserslautern.

A great number of different types have been constructed at this factory.

Fig. 140 shows the section of a *Zimmerschachtofen*, which burns at the side of a corridor, and is frequently used in hospitals, schools, prisons, assembly rooms, etc., etc.

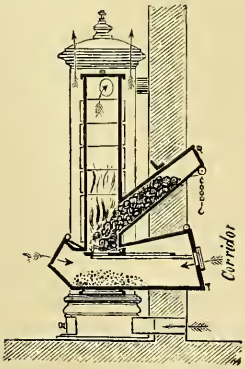


FIG. 140.—SECTION OF ZIMMERSCHACHTOFEN.

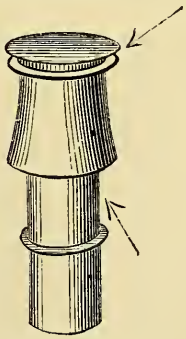


FIG. 141.—LUFTSAUGER VENTILATOR.

An apparatus similar to the English air-pump ventilators and the French aspirators, is used by the Germans, under the name of *Luftsauger* (air-pump). The one most commonly used, and the best, constructed by Professor Wolpert, is shown Fig. 141. The construction is remarkably simple but very effective. It may either be fixed into the chimney or into ventilating-pipes.

Another ventilating apparatus used for rooms is shown in Fig. 142. It was invented by Sarazin, and made at Kaiserslautern. It may be adapted to any aspirating-pipes. If the pipes do not communicate with any heated fire-place, the apparatus may be warmed by means of a simple lamp. It is very convenient for the ventilation of water-closets. Fig. 143 shows how it is applied to public water-closets in Germany, which have a discharge-pipe into a fixed or movable cesspool.

In Germany, as in France, there are mechanical ventilators put in motion by water-power. The best is called the *Aérophone*, made by Treutler & Schwartz, of Berlin.

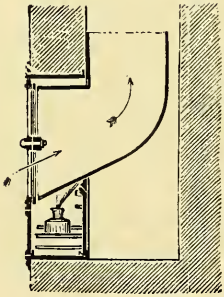


FIG. 142.—THE SARAZIN VENTILATING APPARATUS.

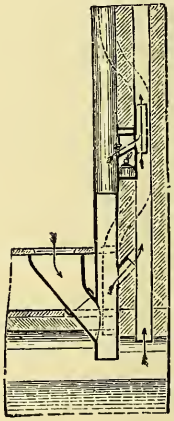


FIG. 143.—APPLICATION OF THE SARAZIN VENTILATOR TO A WATER-CLOSET.

It is composed of a pipe inclosing bellows, put into play by a jet of water from the water-service. According to the position given to the bellows the apparatus may be used either to draw in the air or to expel it.

As all the parts are in constant motion, the machine is soon worn out by the friction. It is, however, very useful for the ventilation of factories where there is much dust, because of the strong current of air which can be produced. In this case it can be put in motion by means of gearing connected with the machinery of the factory.

Sanitary Arrangements relating to Water.—The soil on which Berlin is built is composed of porous sand, and as the ground is only 3 mètres above the level of the river, the whole city is abundantly supplied with subsoil-water. Up to 1832, the year when the the first water-service

was established, there was a well in almost every yard, and it was therefore difficult to induce owners to introduce the town water into their houses.

Berlin possesses two systems of water-works: the oldest, that of Stralau (*Stralauer Wasserwerke*), first constructed by an English company, draws its water from the Spree above the city; the new works (*Tegeler Wasserwerke*) to the north-west of the city are supplied by the lake of that name, which is, properly speaking, only a winding of the river Havel.

In both these systems the water passes through a filter of sand, and comes out limpid, pure, and agreeable to the taste. The works of Stralau possess eight uncovered filters and three covered ones; those of Tegel have seventeen filters all covered.

The water of the Stralau system is brought directly into the houses by force of machinery, that of the Tegel system is raised by pumps into water-towers, whence it is carried into the houses by its own pressure.

Considering the quantity of water contained in the soil, and in order to avoid filtration, the water intended for the aqueduct of Tegel was at first collected into wells of great depth. But, though this water when brought to the surface was perfectly clear and proved to be pure by analysis, it had the property of becoming turbid when in the reservoirs. This change occasioned the growth of a kind of fungus, the *Crenothrix Polyspora*, which was developed in large quantities and polluted the water. It was found that the turbid water contained phosphate and hydrate of iron mingled with particles of decomposed crenothrix. These mineral elements were formed by the oxidation of the ferruginous salts contained in the ground-water, when brought into contact with the air, the iron compounds being essential to the life of the crenothrix.

The surface of the filter is cleaned once in eleven days during the summer, and once in from four to six weeks in the winter; but the cleansing can only be performed in the covered filters. Only 1 to 1½ centimètre is taken away each time from the upper bed of sand. When the operation has been repeated about fifty times and nearly 60 centimètres of sand have been removed, it is replaced by another purified bed of equal thickness. The gravel and stone at the bottom of the filter do not need to be removed or washed, because the sand is fine and even, and the filtration slow and constant. The last point is of great importance, because if the filtering is quick and irregular, solid matters are retained by the grains of sand.

At Tegel, each filter is provided with mechanism which regulates the rate of filtration so as to render it uniform. The cleansing of the sand goes on automatically.

The two establishments deliver 146,400 cubic mètres of water per day, thus allowing more than 100 litres to each inhabitant.

The water was once paid for by a charge on the rent, rising to 4 per cent., but now the supply is estimated by meters. Analyses of the water are regularly made at the Laboratory of the Institute of Hygiene.

Foods. Superintendence of the Sale of Foods.—There is no laboratory in Berlin specially devoted to the examination of foods. The analyses considered necessary by the police are performed at the private laboratory of the chemist, Dr. Bischoff.

A special division of the police, called *Markt-Polizei*, is charged with this inspection, under the direction of a police officer (*Polizei-Hauptmann*).

The inspectors go through a quarter of the city every week, for two days, and bring samples of previously selected provisions.

When the sample is taken, the vendor receives a ticket, on the presentation of which he is paid, if the samples prove satisfactory.

For the purpose of taking samples the inspector brings suitable vases, boxes, pots, glasses, or envelopes, which are sealed and labelled on the spot. All the samples, are registered in a journal, a copy of which is sent with the article to the laboratory.

All adulterated or tainted food is confiscated and the case brought before the tribunals.

Inspection of Meat.—In virtue of a minute drawn up in 1887 by the Municipal Council, all meats exposed for sale in Berlin are previously submitted to inspection made by a service named *Städtisches Fleischesamt*. It is composed of a veterinary surgeon of the first class, several veterinary surgeons of inferior rank, collectors of samples, and microscopists.

It is also the duty of these officials to inspect the market for beef and the abattoir called *Central Vieh- und Schlachthof*. The superintendence is organized exactly as in Paris. Offices for inspection are established in all the markets, as well as in the abattoir and in the railway stations, from which meat is brought into the city.

The French and German systems differ, however, in some respects.

In Berlin all pork must be examined with the view of discovering trichinæ, according to regulations already mentioned.

A veterinary surgeon is attached to each office. Every vendor of condemned meat has the right of appeal to the head-surgeon.

All meat brought into the city should be accompanied by a certificate from the local police, the veterinary surgeonor the inspector, certifying that it comes from animals known to be healthy at the time of slaughter, or marked and sealed so as to show that the animal was killed in a public abattoir duly inspected. Although the city has thus organized effective inspection, the police have also their duties entrusted to a special staff under the direction of the veterinary surgeon for each department.

All damaged meat is seized by the police.

Markets.—Since the year 1887, the sale of provisions, which formerly took place in open markets, has been transferred to four covered markets, like those in London and Paris. Three more will probably be shortly built.

The principal one, the *Central-Markthalle*, is situated near the place Alexandre, not far from the Hotel de Ville, and very near the central

railway station, by means of which provision is made for the reception of the greater part of the meat which is sent to the city.

The market has two storeys; it is divided by a passage separating it into two buildings. The alleys are 2 mètres in width; the stalls for sale 2 mètres in depth, they are arranged in the same manner as in Paris. Their area varies from 3 to 5 square mètres according to the distance between the pillars. Some stalls are as much as 10 to 15 mètres in area.

The meat-stalls are separated by a trellis-work of iron fixed to cast-iron pillars, an arrangement which permits the air to circulate freely. The iron is galvanized.

The top of the tables is white marble. The small stalls are closed midway in the front, the larger ones are open. There are several rows of marble basins with running water used for live fish, closed at the top by iron trellis-work. Their dimensions vary from 1 to 2·30 mètres in length by 0·90 centimètres in breadth; the depth is 50 centimètres.

The upper galleries are chiefly used for the sale of dry merchandise, pottery, porcelain, etc., etc.

A range of cellars runs under the floor.

The electric light is used. Ventilation is effected by the entrance doors, skylights, and a system of aspiration. An abundant supply of water and good drainage make the cleansing of the place easy. The cost of building, not including the value of the ground, was 2,700,000 francs.

Milk Trade.—(*Polizei-Verordnung 6th July*, 1887.)

Milk may be sold in the following forms:—

Unskimmed Milk (*Vollmilch*), containing at least 2·7 per cent. of fat, and having a specific gravity of 1·028, equal to 14° of the official lactometer used by the police, at the temperature of + 15° C.

Skim-milk (*Halbmilch*), having 1·5 per cent. of fat, and at the temperature of 15° C., a density of 1·030, equal to 15° of the official lactometer.

Thin milk skimmed by centrifugal force (*Magermilch*) containing only 0·15 per cent. of fat, and at the temperature of 15° C., a specific gravity of 1·032 or 16° of the official lactometer.

Clotted milk is not subject to inspection.

The sale of sour, viscous or acid milk is prohibited, also milk of a blue or reddish tint, or milk with any blood in it. It is also forbidden to sell the milk of diseased animals, or milk adulterated in any way whatever.

Persons who wish to sell milk must obtain permission from the police.

The use of vessels made of copper, brass, zinc, or badly varnished pottery is forbidden, also vessels of iron when the enamel contains lead.

All utensils employed must be kept perfectly clean.

The vessels used for each kind of milk must bear a legible, irremovable ticket indicating their contents.

Hand-carts for milk which remain closed and are provided with taps must have the price marked on the latter.

Places for the sale of milk must be kept clean and carefully ventilated,

they must not be used as bed-rooms or sick-rooms, nor must they be in direct communication with any apartments so used.

Persons attacked with any infectious disease and those in attendance on them must not have anything to do with the manipulation of the milk.

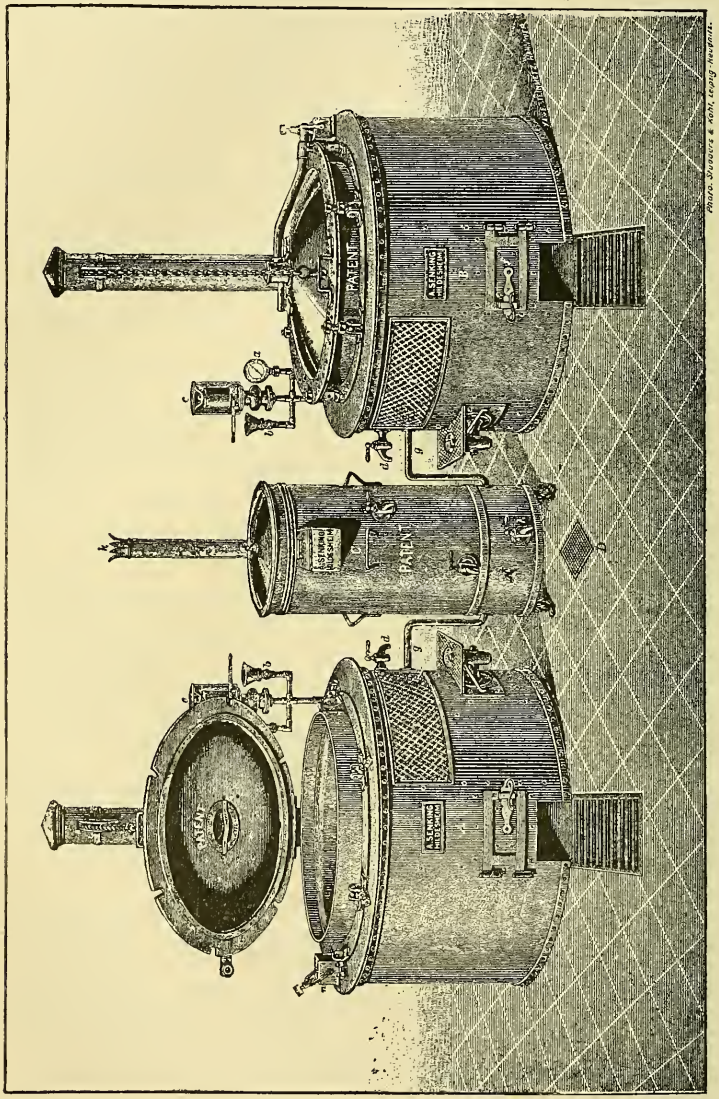


FIG. 144.—THE SENKINS MENAGEHERD STOVE.

Cow-keepers must permit the inspection of the cows by the veterinary surgeon of the district at any time.

For the practical regulation of milk-inspection the administration has published directions (*Ausführungs-Anweisung*) assigning this duty to in-

spectors attached to the police service, who are instructed to examine the specific gravity of the milk.

Before testing, the milk must be well stirred, the lactometer must be left for at least two minutes before looking at the degrees on the scale; it is

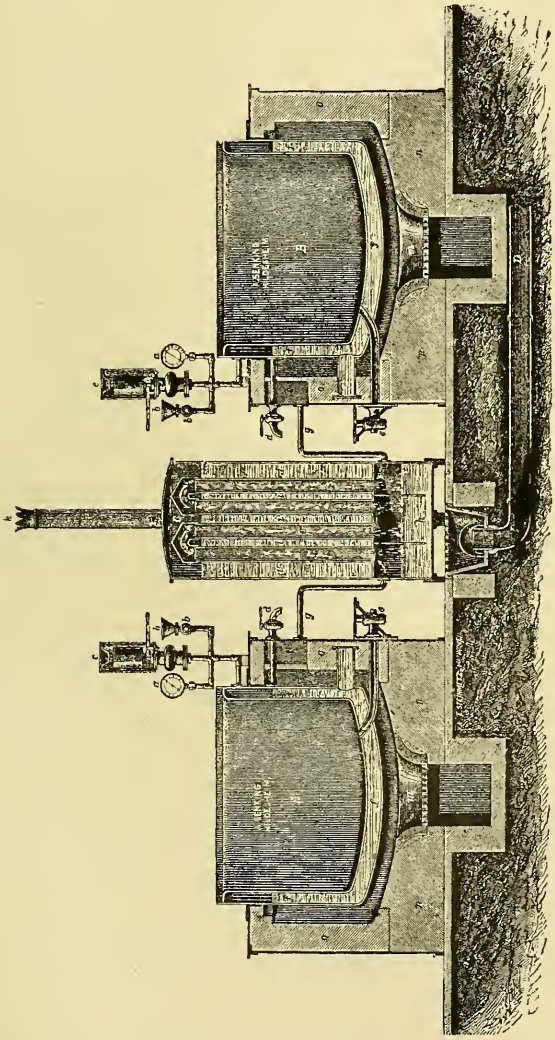


FIG. 145.—SECTION OF THE SENKINS MENAGEHERD STOVE.

furnished with graduated thermometer so arranged that 0° corresponds to + 15° C. Each degree above 0° is added to, and each degree below 0° is subtracted from the number registered by the instrument in order to reduce the density to the normal, which is + 15° C.

When the milk is examined, notice must be taken of its odour and taste.

When milk does not fulfil the desired conditions, or seems suspicious, a sample of half a litre must be taken, put into a bottle, sealed and labelled, in order that it may be submitted to chemical analysis.

Milk which will not bear the tests is thrown away and the cost of inspection is charged to the vendor, who is also liable to legal proceedings.

Public Kitchens.—The efforts which have been made for the purpose of providing wholesome and substantial food to the poorer classes must be reckoned among the most important measures of social hygiene.

One of these measures is the establishment of public kitchens called *Volksküchen*, where workmen may procure hot provisions at the lowest possible prices. Germany seems to be distinguished above other countries by the practical character of its efforts in this direction.

This work was originated by private beneficence, but it is now subsidized by the Communes.

The city of Berlin possesses nearly twenty establishments of this kind. The food is cooked by steam, so that the juices are retained; there is no waste, and less labour is required for its preparation.

The most simple and useful stove of this kind is the *Senkins Menage-herd*, invented by the engineer Senkin de Hildesheim. Its construction is shown in Figures 144 and 145.

The boilers have double walls, between which is a space filled with water (*f*). The food is thus cooked in a water-bath, and cannot be burned. The steam which escapes is conducted by pipes (*g*) into a condenser (*c*), where it is condensed and falls to the bottom as water (*h*), which flows to the drain by a discharge-pipe (*d*).

There are similar apparatus which are easily moved, for the use of troops on the march, workmen's associations, etc.

Sanitary Arrangements relating to the Ground. Flushing of Sewers.—Most of the streets in Berlin are paved with stone; but some of the most aristocratic and most frequented are asphalted. Of late years wood pavement has been introduced with good results, as in Paris and London.

The cleansing of the streets is done at the cost of the city and organized after the English system. In the principal streets receptacles in the form of pillars are placed near the footways, as in London, for the droppings of horses, which are swept up when necessary.

The mechanical brushes (see p. 297) find great favour in Berlin. It is calculated that a machine of this kind can do as much work as fourteen men at one-sixth of the cost.

The removal of the street refuse is left to contractors, who select the places for depositing it. The greater part of the rubbish is put on barges at once, which transport it to the country to be used as manure.

The duty of removing solid refuse from their yards devolves on the owners. It is collected into hermetically closed receptacles, which are emptied when necessary.

The streets are watered at least twice a day during dry weather.

System of Latrines.—According to the new regulations for buildings, established in 1887, the early systems of latrines allowed in Berlin are water-closets and movable tubs. The first are organized in the English way, the second, like those used in France, are composed of tubs placed in isolated vaults, into which open discharge-pipes passing through each storey of the houses, and having the upper extremity continued above the roof for ventilation.

Drainage.—At Berlin, as elsewhere, experience has proved that sewers built without a general plan, having no end in view but that of pouring the sewage into the nearest stream of water, need to be reconstructed within a short time. This is necessary because, when the fall is too small and the flushing insufficient, deposits of refuse are formed, mephitic gases are disengaged, the diameter of the pipes becomes too small as the population increases; and lastly, low neighbourhoods and cellars are inundated in rainy weather.

The first system of drainage for the city of Berlin dates from the year 1852. The new system was inaugurated twenty years after in 1872.

Before undertaking these important works three competent persons were sent to study the subject in London and Paris. The present system proposed by one of them—the consulting architect (*Baurath*) Hobrecht—is modelled on the English system (see p. 134).

In conjunction with the system of sewers, irrigation has been organized on a sufficiently large scale to purify the whole of the sewage.

The soil being uniformly flat, the city has been divided into twelve districts, each provided with a system of sewers (*Radialsystem*). The sewage of each district is brought to a depôt whence it is driven on to the sewage farms through cast-iron pipes placed at the depth of 1 mètre below the ground. On its arrival at the pumping station, the water is received into a reservoir 12 mètres in diameter divided in the centre by a grating of iron, which keeps back the solid substances.

The principal sewers are constructed in masonry; they are of an oval form, from 0·90 to 2 mètres in height. The smaller ones are made of glazed earthenware with a diameter of 21 to 48 centimètres.

The openings, which are covered with a grating, are from 60 to 80 mètres apart, placed where the fall and direction of the pipes change. They are generally so contrived that the different parts of the network may be accessible for cleansing and flushing. Rain-water from the streets is received into catch-pits placed at the side of the footway about 60 mètres apart, with syphon traps between them and the sewers. They are usually covered with a grating.

When storms of rain occur, auxiliary pipes carry part of the water directly to the canals or the Sprée.

Ventilation is effected by means of the openings and pipes which communicate directly with the sewers. The methods of cleansing and flushing present certain peculiarities.

The great sewers are traversed by three workmen shod with high water-

proof boots. The first, who carries a lantern, stirs up the deposits at the bottom with his feet; the next has a wooden shovel with which he pushes the heap before him; the last, who is provided with a broom, cleans the ground laid bare by the others.

The flushing is effected from the street openings into the sewer. The junction of these with the sewer is closed by means of a plug fixed to a small chain; the manhole is filled with water, then the plug is removed. If necessary, the flushing is repeated; and, meanwhile, workmen stir the deposits in lower parts of the same sewer, so that they may be removed by the flushing. The smaller sewers are cleaned with cylindrical brushes (*Wischer*), of different sizes, having a cord at each end. At one end is fastened a float, which is introduced into the pipe and carried along it by the current, aided, if necessary, by a flush of water. The workmen then draw the brush through the pipe. Small brushes are first used, then large ones. This work is performed at regular intervals; each pipe is flushed once in twelve days, each great sewer once in twenty days; but the cleansing with brushes only takes place at intervals of from two to six years.

The sand is removed from the sewers in buckets; this work is paid for by measure. Men who labour in the sewers receive about 3 marks for 110 buckets, those who work outside receive about 2 marks.

Sewage-Farms.—The sewage-farms in the vicinity of Berlin consist of four large tracts of arable land placed as shown in Fig. 146.

Besides these extensive farms, there are several small ones; and some private persons have made arrangements with the City, so that their fields are irrigated with the sewage. The vegetation of the irrigated land is exceedingly rich, so that this is the only means by which they can successfully compete with the public sewage-farm. The sewage-farms belonging to the City cover about 5,828 hectares. Grass is principally cultivated, also corn and beetroot. At Malchow there is an horticultural establishment for the growth of all kinds of fruit and flowers. One hectare is allowed for every 250 inhabitants. Great shallow reservoirs have been constructed (*Staubassins*), several hectares in extent, into which the sewage was conducted for the winter, in spring they were emptied and the ground sown. This system has been abandoned, since experience has shown that the cold does not interfere with regular irrigation. The sewage forms, with the snow, a crust of ice, under which the irrigation can follow its course without interruption.

Exact statistics as to the sanitary state of the neighbourhood have been kept, proving that it is satisfactory, and that no case of disease can be traced to the irrigation.

Vagrants, unfortunate persons, and inmates of the house of correction in the City (*Rummelsburg*) have been lately employed on the sewage-farms, and it has been remarked that they have better health than those kept in the establishment.

A splendid vegetation delights the eyes of persons walking in the fields; no unpleasant odour is perceptible except during the process of irrigation,

and even then the emanations are not stronger than those from fields manured in the ordinary way.

FIG. 146.—PLAN OF SEWAGE-FARMS NEAR BERLIN.

1. Sewage-farms of Osdorf, Friederikendorf and Heinersdorf, 1,242 hectares; 2. Grossburm, 977 h; 3. Falkenberg, Buerknersfelde, Hohen-Schonhausen, Wartenburg, Blankenberg, Malchow, Hellersdorf, 2,685 h.; 4. Rosenthal, Blankenfelde, Möllersfelde, 980 h; 5. Lake of Tegel; 6. The River Fliers; 7. Canal for the sewage.

Stables and Coachhouses.—The regulations for Berlin, under the head of buildings, comprise also regulations for the above.

Markets for Cattle and Abattoirs (*Central Vieh- und Schlachthof*).—By virtue of a general regulation of the 18th March, 1868, and a supplementary decree of the 9th March, 1881, the Communes are authorized to establish compulsory inspection of animals for slaughter, and of meat before it is exposed for sale. The market for cattle and abattoir for Berlin are placed on the same site, and cover a surface of 11·76 hectares. Several ranges of stables for different kinds of cattle are built on the market-ground. Suspected animals coming from the country are placed in the most remote part of the ground, in a separate stable with an abattoir attached to it.

The ground is paved with stone; the chief galleries of the stalls are covered with iron on a bed of concrete; others are cemented. One side of the ground is occupied by abattoirs arranged in compartments, having beside them stalls for the slaughtering of cattle.

At the other end is the abattoir for the use of the police (*Polizei-*

Schlachthaus), to which the condemned animals and the meat which has been seized are brought.

The abattoirs for sheep and horned cattle are composed of a central part, having an abattoir on each side measuring 9 mètres in depth, 5 in breadth, and 5 mètres high; each compartment has a cellar.

The roofs of the abattoirs and cellars are vaulted; the walls of the cellars are lime-washed; the abattoirs are lined with cement to a height of 2·25 mètres.

The ground is covered with Metlach mosaic in cement. Ventilation is effected by windows which reach to the roof, and are provided with a sky-light in the centre. The eaves of the roof project to the extent of 3 mètres in order that the rays of the sun may be intercepted.

The killing of pigs is managed in the same way, a hall in the centre and compartments on each side. Slaughtering and scalding are done in the middle stall, which is the largest. The smaller ones at the side are used for cutting up and sorting the meat. The pigs are driven into narrow passages at the end of which they are slaughtered.

On the site of the market there is a tripe-shop, also places for the melting of tallow and the preparation of albumen. A room is kept for washing the intestines.

The solid manure is taken away in carts on rails which adjoin the abattoirs; the liquid falls into the sewers, and thence to the sewage farms.

All the waggons which have brought cattle are cleansed and disinfected on the spot. Nearly eighty arrive every day by different routes. They are cleared from litter and manure, then washed outside and inside with plenty of water, afterwards scrubbed with a brush dipped in a solution of 500 grammes of carbonate of soda per 100 litres of water at a temperature of 70° C.

Quick-lime is mixed with the litter and manure in the proportion of 4·50 kilogrammes to each waggon-load.

Preventive Measures against Infectious Diseases. Vaccination.—Since 1802 an establishment has existed at Berlin, *Königliche Impfanstalt*, which has lost part of its importance since the regulation for compulsory vaccination was made (1874). It is still, however, employed as a depôt for vaccine, providing human vaccine mixed with glycerine, which is sent away in glass tubes. The manager also makes arrangements for obtaining animal vaccine from the veterinary school. Calves are chosen which are at least six or eight weeks old, heifers being preferred. They are fed exclusively on unskimmed milk. The vaccine is taken on the fifth day. The crust is removed and the pulp mixed with glycerine; the vaccine is then collected into capillary tubes, which are closed with sealing-wax.

The Municipal Authorities have resolved to found an establishment, *Städtische Impfanstalt*, in the Central Vieh- hof, for the culture of animal vaccine at the expense of the city.

Berlin is divided into districts for vaccination which correspond to the police districts.

The establishment, *Königliche Impfanstalt*, forms a district by itself.

Hospitals for Isolation.—At Berlin the preventive measures against infectious diseases are organized according to the regulations in force throughout the Empire.

A large hospital for isolation has been built by the corporation, composed of twenty-four detached pavilions of one storey, with an additional building for emergencies. A space is reserved for the construction of six additional pavilions.

This hospital, *das städtische Krankenhaus Moabit*, is situated in a space nearly open on all sides in the Moabit quarter, near to the public park, and small Thiergarten. The ground has the form of an elongated rectangle. Pavilions are built on the long sides facing east and west. The distance between each is 17 mètres, and the two sides are separated by 64 mètres. The intermediate space is occupied by lawns, groups of trees, and shrubs.

The buildings cover a surface of 10,000 square mètres, of which 6,432 are occupied by buildings; the grounds, mortuaries, etc., take up the remainder.

Each pavilion contains a ward 28·25 mètres in length, 6·90 mètres in width, and 3·14 mètres in height. Each contains thirty beds—too many in a hospital for infectious diseases, as that allows only 27 cubic mètres for each patient. The ward is lighted by windows in the side walls, one being placed between every two beds.

The materials employed in the construction are blocks of wood intercalated with bricks. The inside walls are lined with boards painted in oil a bright colour. The floor is formed of a bed of concrete 8 centimètres in thickness, resting on the sandy soil covered with cement 6 mètres in thickness.

There are no ceilings. The roof is composed of a double layer of boards painted in oil inside, and covered outside with millboard saturated with asphalte.

A skylight runs along the middle of the roof with latera apertures, which may be opened and shut from within.

A vestibule at one end, traversed by the entrance corridors, comprises on its right side servants' rooms and the dispensary, and on the left the bath-room, linen-room, and water-closets. All these rooms have boarded floors.

The heating is effected by means of steam-pipes connected with a boiler, which also serves for the kitchen and laundry. A large steam-pipe runs in a subterranean trench in front of the pavilions, sending a branch to each, which is subdivided into several pipes for warming the rooms and heating water for the bath-room. Three steam-pipes, two to the north and one to the south, run above the floor at a height of 0·30 mètres; they are provided with taps for the regulation of the temperature. The condensed water returns to the boiler by a pipe.

Ventilation is very simply managed. Fresh air is introduced by means of fourteen openings, each 18 centimètres wide, made in the walls of each

ward at the same height as the steam-pipes, which warm the air as it enters. The impure air escapes by the lateral apertures above.

The rooms, etc., are lighted with gas; the lamps are hung below the skylight, and assist in the ventilation.

The pavilion for special isolation attached to the hospital is similarly constructed, and measures 15·67 mètres in length by 8 mètres in width, and 3·64 mètres in height. It contains three rooms separated from one another, each having three beds. A covered verandah, 2·30 mètres in height, runs along the front. Large doors at each end set up a current of fresh air.

Eleven casements are placed in the front of the verandah near the roof, which are removed during the summer.

A water-closet is provided for each room, placed in a vestibule, and abutting on an outside wall, being perfectly ventilated and separated from the ward by an ante-chamber.

Each of the wards has a roof of a pyramidal form, at the top of which is a ventilating-pipe surmounted with a Wolpert aspirator. The floors are made of brick covered with Metlach mosaic.

Heating is effected by steam introduced into hot-air stoves, placed in the middle of the floor, and so constructed that the heat can be regulated. The stoves are surrounded with an iron jacket.

Fresh air is supplied to the apparatus by a trench in masonry under the floor, and is warmed in passing between the stove and the jacket. The impure air escapes partly by the ventilating-pipe in the roof, partly by other pipes adjoining a small tower in the ceiling of the verandah, in which are placed water-cisterns for the baths.

The rooms may also be heated by steam-pipes.

At one end of the verandah is a small enclosed room, into which linen for the wash is thrown through a trap-door; it is taken away by a door communicating with the open air.

There is a place for disinfection in the establishment through which the linen is passed.

When no epidemic prevails, part of the hospital is given up to ordinary patients. It is, however, considered preferable to nurse the latter in the *städtische allgemeine Krankenhaus Friedrichshain*, which is a splendid hospital built in pavilions, four of which have one storey and six two storeys. There are also two pavilions for isolation with two storeys and another of one storey exclusively reserved for diphtheritic patients.

In the department for isolation each adult is allowed a space of 57 to 60 cubic mètres, and each child 31 to 42 cubic mètres.

The pavilion for diphtheria is warmed by steam, but the general method is a combination of heating by means of hot-water apparatus connected with the ventilation. Each ward has also chimneys open in the summer and autumn.

In order to assist ventilation the smoke-pipes pass through the ventilating-shaft.

The removal of persons suffering from infectious diseases is entrusted to

contractors charged with the maintenance of the necessary carriages, the use of public carriages being forbidden to such patients in virtue of an official order of the 7th February, 1887.

Disinfection (*Polizei-Verordnung, 7th February*, 1887).—The regulations for disinfection in force in Berlin are as follows :—

Every head of a family is bound in the event of illness or death from cholera, small-pox, spotted typhus, remittent fever, and diphtheria to disinfect everything which has been used by the patient and the room he has occupied conformedly to the established regulations.

The same must be done in cases of typhoid fever, malignant scarlet fever, or dysentery, if required by the police. The public is also bound to disinfect in cases of measles, whooping cough, and pulmonary phthisis. A disease may be communicated by—

1. The patient himself and his evacuations; 2. By dead bodies; 3. By food and articles used by the patient; 4. By persons in contact with the sick; 5. By the room he has occupied.

Account must be taken of all these considerations, and measures must include—

1. The utmost care in maintaining cleanliness about the patient, the sick-room, and all articles in it.

2. Frequent renewal of the air.

3. The destruction of germs.

The patient should be washed every day, the linen changed every day if possible; the room must be washed with wet cloths, which should afterwards be boiled for half an hour.

The air must be renewed, partly by windows, which can be protected with a curtain in winter, and partly by the heating apparatus.

The germs of infection are destroyed by means of steam at high pressure in apparatus made for that purpose. The linen and clothes are boiled in water for half an hour, then washed with a solution composed of one part pure carbolic acid mixed with 18 parts of water (strong solution) or 45 parts of water (weak solution). Articles of small value are burnt.

If the patient is not taken to the hospital, he must be isolated as much as possible in a room not communicating with other rooms.

No articles in the sick-room must be taken away before disinfection. The linen used by the patient, clothes, etc., which can be washed must be steeped without shaking in a weak solution of carbolic acid for twenty-four hours at least, then boiled for half an hour in water, and finally washed with a mixture of 20 grammes of potash soap to 10 litres of water.

Patients suffering from cholera, typhus, diphtheria, scarlet fever, or dysentery must use a vessel a quarter filled with a strong solution of carbolic acid for evacuations, which must be emptied into the latrines. Infectious excretions are: in cholera, the vomit, fæces, and urine; in diphtheria and scarlet fever, the expectoration, saliva from the mouth, nasal mucus, and urine; in all typhoid diseases and in dysentery, the evacuations. Persons suffering from these diseases must not use the water-

closets. If they should have done so before the nature of the malady was known, the seat and pan of the closets must be washed with a strong solution of carbolic acid, and 3 or 4 litres of the same solution must be poured into the pan.

Bad odours may be prevented by the prompt removal of fæces, bandages, etc., and careful ventilation. Fumigation by means of aromatic substances is of no value in disinfection.

At the close of an illness all articles which cannot be washed, such as bedding, silk, carpet, furs, stuffed furniture (excepting the wood), are taken away with care, without shaking or beating, to the disinfecting establishment, after they have been wrapped in a cloth steeped in a solution of carbolic acid. Vehicles belonging to this establishment must be used for their removal.

Leather is washed with the solution, articles of small value are burnt in a stove belonging to the house. Cooking must not be carried on at the same time. Large articles are burnt in the disinfecting establishment. Polished furniture, pictures, objects of art, metals, etc., are rubbed with cloths; bread is used for the walls and hangings.

The floor must be first wetted with a strong solution of carbolic acid.

If the walls have been soiled with the evacuations, they must be wetted with the carbolic solution and then scraped.

All floors without exception, doors, windows, and woodwork not polished, must be washed with a strong solution of carbolic acid after cases of cholera, small-pox, diphtheria, spotted typhus, and remittent fever. The solution must be injected into the crevices of the parquet. Everything must afterwards be washed with pure water.

The bread and cloths used in cleaning must be thrown into the fire. Any cloths to be used again are soaked in a weak solution of carbolic acid for twenty-four hours, then boiled and washed with potash soap.

After disinfection the room must be aired for twenty-four hours.

The use of public carriages for persons suffering from infectious disease is forbidden; they must be removed in special vehicles supplied by the police.

Before returning to ordinary life convalescents must take a warm bath, or at least wash all over with soap, change their linen, and put on clothes which have not been worn during their illness or have since been disinfected.

Corpses must be buried in cloths steeped in a solution of carbolic acid, placed in coffins without being washed, and taken to the mortuary on a hearse as quickly as possible.

Persons who have been in contact with the patients, as well as nurses of both sexes, must wash the face and the hair with the greatest care.

Disinfectors must wear a special dress while performing their duties, and afterwards they must wash and change their clothes.

When disinfection is not compulsory (for cases of typhoid fever, scarlet fever, or dysentery) the medical attendant must decide whether it should

take place, also in each case of measles, whooping cough, and pulmonary phthisis.

In Germany disinfection is entrusted to the *geprüfte Heildiener*, a kind of licensed surgeon, and to disinfectors approved by the administration, who are bound to proceed with the work without delay. They receive a fixed payment, from about 3 marks for each room, with the price of the disinfectantsused.

The city of Berlin possesses two establishments for disinfection: one annexed to the night refuge (*Asyl für Obdachlose*), the other in the Reichenburgerstrasse.

In each establishment there are three stoves constructed after the Schimmel system. They do not differ much from those used in France, made by Geneste & Herscher, shown p. 338. The establishments are divided into two distinct sections, the one used for the infected articles, the other for the purified ones. Each has a bath-room, coach-house, etc.

The arrangements are the same as those on the plan framed by the city of Paris, p. 337.

The decree of 1887 having made disinfection compulsory, great difficulty has been found in applying it to all cases of infectious disease. This difficulty has led to the division of diseases into several classes with varying obligations.

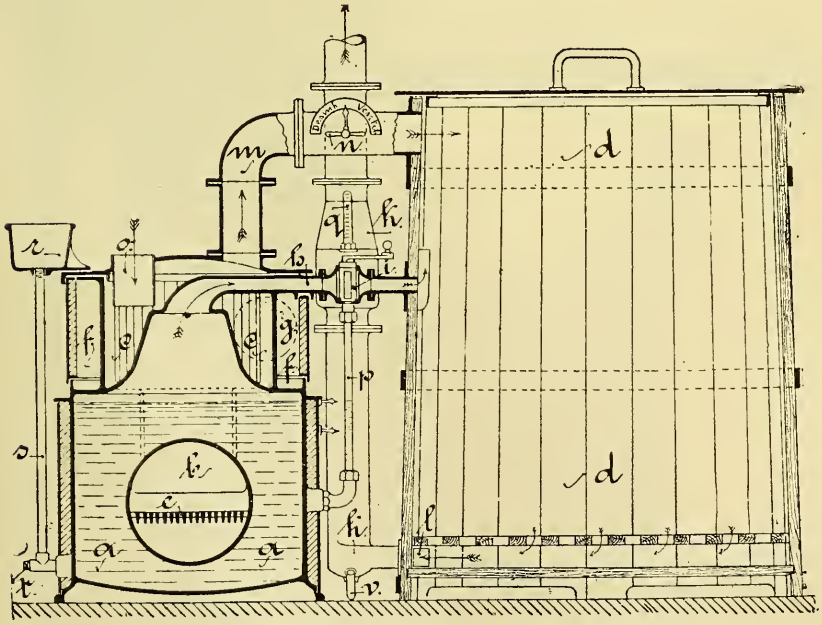


FIG. 147.—HENNEBERG'S FIXED DISINFECTOR.

o. Opening for fresh air. *p*. Pressure-guage. *q*. Thermometer. Flannel for filling. *s*. Water-pipe. *t*. Tap for emptying the boiler. *z*. Exit pipe for condensed water.

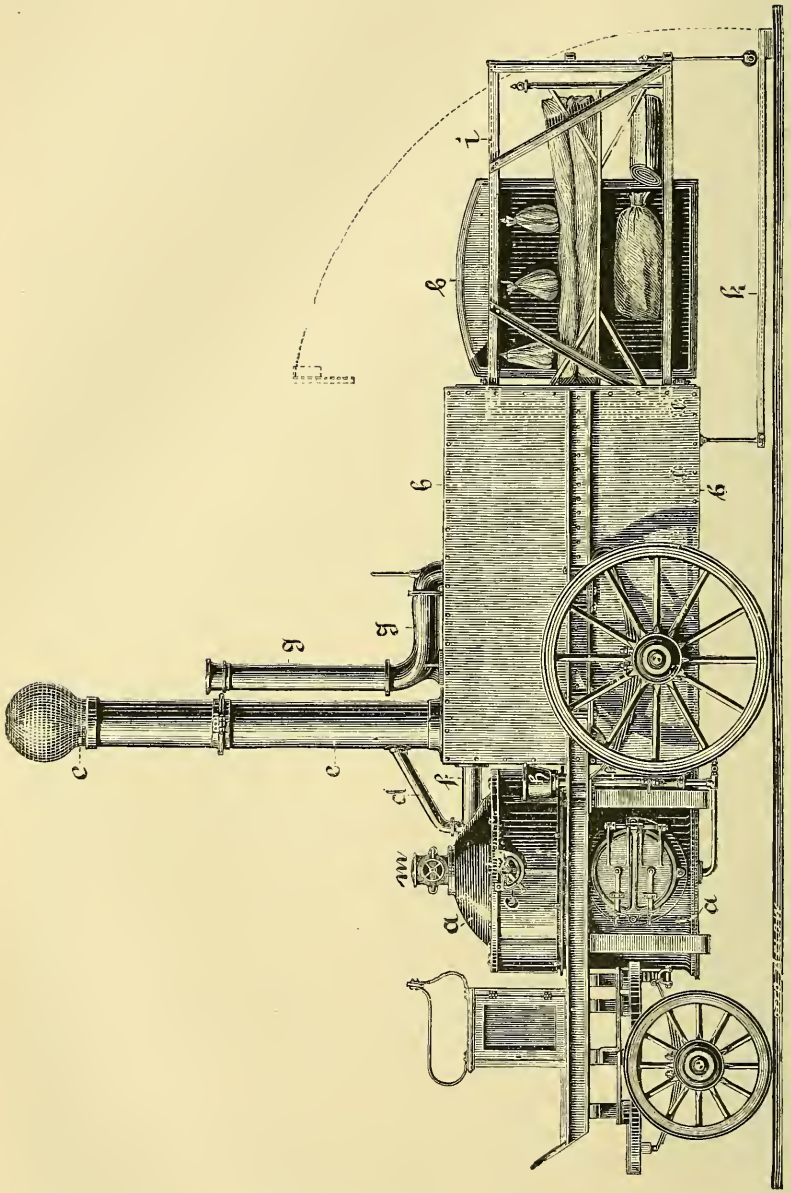


FIG. 148.—MOVABLE HENNEBERG'S DISINFECTOR.

a. Boiler for water. *b*. Disinfecting chamber. *c*. Tap for stopping the steam and allowing it to go out. *d*. Discharge-pipe for steam. *e*. Chimney with fine metallic grating. *f*. Steam-pipe opening into disinfecting chamber. *g*. Exit pipe for the steam in the chamber. *h*. Funnel for filling, with a level. *i*. Shelves for the articles to be disinfected. *k*. Rails for pushing the shelves into the disinfecting chamber. *l*. Castors on which the shelves move. *m*. Opening by which ventilation is effected.

The new regulations for disinfection, of which we have just been speaking, make no mention of corrosive sublimate, which is generally considered an efficacious germicide, and was recommended in the regulation of 1883. Because of the property it possesses of forming insoluble combinations with sulphuric acid, ammonia, and albumen, Koch had already in 1883 thrown doubt on its efficacy for the disinfection of fæces; Schiller and Fischer have shown that it does not destroy the bacilli of tuberculosis. These facts, and the extremely poisonous nature of the substance, have caused it to be excluded from the new regulations.

Besides the Schimmel stove for disinfection with a separate boiler, several apparatus are in use, less costly and of more simple construction. The following are the most generally known and considered the best :—

Henneberg's disinfector, used in several of the Berlin hospitals, is made in several forms. Figure 147 shows a fixed apparatus composed of two parts : the boiler (*a*), a stove (*b*), receiver for hot air (*c*), a chamber for disinfection (*d*), made of wood, closed at the top with a lid of sheet-iron.

The gases produced by combustion pass from the grating (*e*) into the supply pipe (*f*), heating the air in the receiver (*c*), which is furnished with internal plates to increase the heating surfaces ; the gases afterwards pass into the smoke-pipe (*g*).

A pipe (*h*) conducts the steam from the boiler into the disinfecting chamber (*d*). This pipe has a tap (*i*), which excludes the steam from the disinfecting chamber, and causes it to pass into the air by the pipe (*k*).

The steam leaves the disinfecting chamber by the opening (*l*) made at the bottom of the chamber, and enters the pipe (*k*).

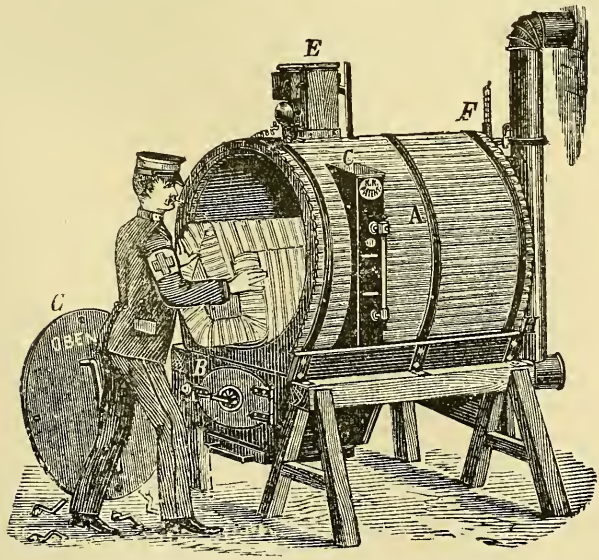


Fig. 149.—Fixed Disinfector made by Schaeffer & Walcker.

When the disinfection is complete, the articles are dried by the introduction of hot air by the pipe (*m*) by means of the tap (*n*).

Fig. 148 represents a movable Henneberg disinfector.

Figs 149 and 150 represent the more simple apparatus made by Schaeffer & Walcker at Berlin. The disinfecting chamber is in the boiler itself, surrounded by a non-conducting material. When the water is heated, the temperature in the disinfecting chamber rises and prevents the steam from condensing.

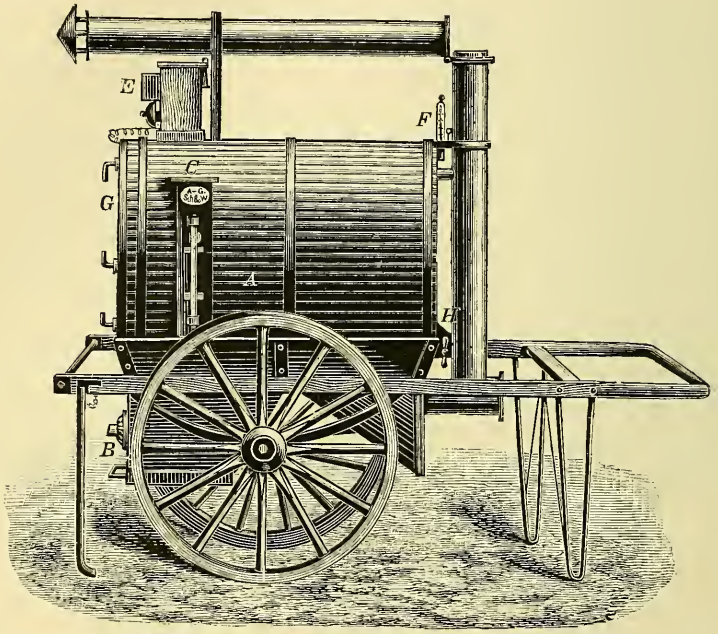


Fig. 150.—Movable Disinfecting Apparatus by Schaeffer & Walcker.

Mortuaries. Places of Burial.—In some of the Berlin cemeteries mortuaries have been built, which are placed at the disposal of the public by the authorities, with the understanding that corpses shall be taken to them as promptly as possible.

The bodies of the poor are placed first in the depository of the old cemetery, within the city enclosure, whence they are removed by night in carriages kept for that purpose to the mortuary in the large cemetery outside the city (*Berliner Ostfriedhof*) to be buried there the next day. The Jews have built a mortuary chapel in their new cemetery at *Weissensee*, which fulfils all the conditions required by modern hygiene, and contains everything necessary for washing, isolating, and enveloping the bodies.

A new establishment, which answers its purpose perfectly, has been built in the old cemetery, *Charité*, used for inquests, *post-mortem* examinations, etc ; also for the exhibition of bodies of unknown persons. The bodies

are preserved from putrefaction by an apparatus in which refrigeration is produced by ammonia and chloride of calcium, as in the Morgue of Paris.

Prostitution.—The law of the 15th May (*Strafgesetzbuch für deutsche Reich*) relating to this subject is as follows :—

Every woman making a profession of debauchery, and for that reason placed under the surveillance of the police, is liable to imprisonment if she infringes the regulations made in the interest of the public health, safety, and good order, also public decency and good manners. Women who are not under the surveillance of the police must conform to the same regulations.

The control of prostitution is thus legally established in Germany. Besides the registered women, a number of others are under the oversight of the police in Berlin, employed in beer-houses, low theatres, troupes of niggers, public balls and coffee houses, called *Wierner Cafés*.

It is calculated that the number of women who practice prostitution secretly is ten times greater than the number of registered women.

Inspection takes place once a week, at the Bureau of Police. All the women who, after careful observation, are suspected of making vice their calling are summoned for examination. On the first occasion a printed paper is given to them by way of warning. In this they promise to earn their living in an honourable manner. Afterwards, if their behaviour in streets and public places is again recognised as suspicious, regular surveillance is enforced.

Public Buildings.—The hospitals recently built at Berlin have been constructed on the model of English hospitals, and realize the most exacting requirements of hygiene. Several, however, differ from them in using the central system of heating,and the water-closets are not so completely isolated.

In some, the central system of heating is combined with the use of chimneys ; in others, heating and ventilation are effected by the stoves with jackets already mentioned. These will probably replace the central system, which is rather complicated.

The hospitals designed for infectious diseases have already been minutely described.

Schools, theatres, and other public buildings must fulfil the required conditions for lighting and ventilation. Plans must be sent to the district medical officers, that they may be examined from the hygienic standpoint.

Dwellings for Workmen.—There are no dwellings built expressly for the working classes in Berlin ; they live where they can. As in other places, the poorer classes reside in the old quarters of the town, in narrow streets, where the hygienic conditions are far from satisfactory. A large number of workmen, especially the unmarried ones, inhabit the *Pennen*, a kind of hotel of inferior rank, where, however, they only lodge at night (*Schlafstellen*). The regulations applicable to places of this description have already been given.

Hygiene of Factories.—In the chapter which treats of the general hygiene of factories (p. 360) we remarked that the inspection instituted for this purpose in Germany was of little value, because the inspectors did not

possess the medical knowledge needed for the efficient discharge of their duties. This shows plainly the need for control of sanitary matters by a central organization.

The inspectors send their reports to the authorities, who make an abstract for the government. It appears from these reports that the hygiene of factories has made but little progress. The medical councillor, Pistor, whose duty it is to sum up the reports of the inspectors for the capital expresses himself in these terms: "Whatever may be the importance attached to the duties of inspectors of factories, it cannot be said that they are competent to the regulation of hygienic questions. The only person who could perform that work effectually would be an inspector trained in medical science."

An association for the sick belonging to the various trades, *Gewerks-Krankenverein* has existed in Berlin since 1846, formed by a combination of all the artisans for the purpose of maintaining a common fund from which they may obtain assistance and medical care. The office is superintended by a committee composed of delegates from all the trades. A council of administration consisting of twenty-five persons is elected every year, forming part of the above-named committee, which is joined to the industrial deputation elected by the Municipal Council. The president of this deputation is at the same time president of the council of administration for the fund.

The city of Berlin and its suburbs are divided into eighty-five districts, with a medical adviser for each.

The number of members of this association of artisans amounts to nearly 200,000. This organization is of the highest importance in checking the spread of infectious diseases. It is through it that exact statistics of syphilitic diseases among that class of the population have been possible. The information supplied by the army for that purpose is also exact.

Hygiene of Schools.—The orders of the 23rd October, 1879, and 14th January, 1880, include regulations applicable throughout the whole of Prussia.

The schoolrooms must not exceed 9 mètres in length, 5·70 mètres to 7 mètres in width; and 3·20 mètres to 3·50 mètres in height.

Each pupil in the lower classes should have a superficial space of 0·7 square mètres, and in the higher classes of 0·9 square mètres.

Daylight may be admitted from the left, or from behind, but not from both sides. The windows must have a surface equal to a fifth of that of the floor. Ventilation and heating must be well managed.

Plans for new school buildings, or alterations in schools already built, must be examined and approved by the district doctor. He is entrusted with the superintendence of school hygiene in general.

In Saxony, Bavaria, Wurtemberg, and Baden, the medical inspector is bound to visit the schools regularly for this purpose, and to address any observations he may judge necessary to the authorities. The regulations for the protection of schools against infectious diseases have been given above (p. 371).

CHAPTER III.

LEIPZIG.

General Remarks.—Water Supply.—System of Water-closets.—Abattoir.—Hospitals for Isolation.

General Remarks.—The hygienic institutions of South Germany differ from those of Prussia, as the medical men entrusted with the superintendence and direction of public hygiene are much more independent of the police administration.

Among the cities of Germany, Leipzig in Saxony is remarkable from the standpoint of its sanitary organization. The aqueducts, the system of sewage, etc., present several peculiarities, which we will now describe.

Water Supply.—Towards the middle of 1860 a system of water supply was established at Leipzig, at *Connewitzer Bauernwiese*, based on the employment of subsoil waters, collected in a bed of gravel by means of perforated glazed earthenware pipes, placed in contact with one another, but without complete joints. As the city extended, new pipes were laid down; but the ground not having been first carefully examined, the water supply proved deficient, and the quality of the water deteriorated.

An original method was employed in order to overcome these difficulties, the invention of Professor Hofmann.

The water of the river Pleisse is conducted into filtering reservoirs dug in the place where the new pipes start; after having traversed these filter-beds it flows through the underlying bed of gravel, and having been filtered and purified, is collected by the earthenware pipes.

As this system did not suffice for the wants of the city, another was constructed in 1887, twenty kilomètres from the city, in the forest of *Naunhof*.

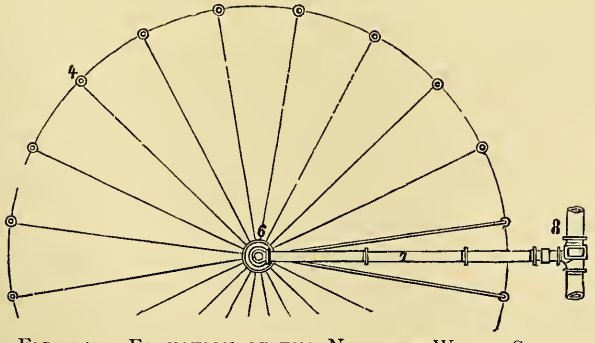


FIG. 151.—ELEVATION OF THE NAUNHOF WATER SYSTEM.

This system was invented by the civil engineer Thien, and still remains the only one of the kind.

After careful investigation, a supply of pure water was discovered below the surface amounting to more than 30,000 cubic mètres a day. This water is collected by five groups of artesian wells, each formed of twenty tubular wells, whence the water is carried by horizontal pipes into a small reservoir. Thence it flows into the great conduit (Figs. 151 and 152).

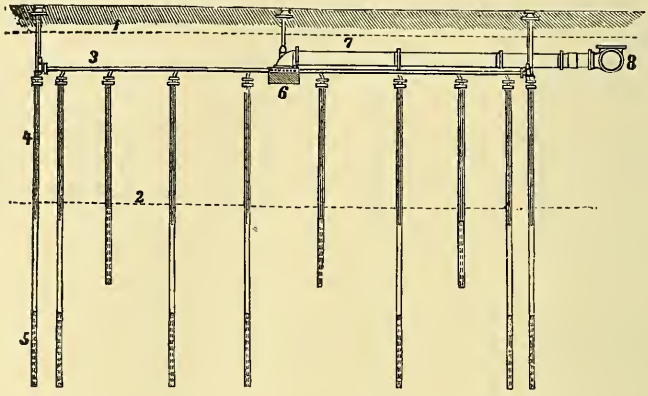


FIG. 152.—PLAN OF THE NAUNHOF WATER SYSTEM.

1. Natural level of subsoil water. 2. Lowered level. 3. Suction-pipe. 4. Tubular wells. 5. Filters. 6. Small central reservoir. 7. Collecting pipe from wells. 8. Great conduit.

This conduit opens into a deep reservoir made in masonry, whence the water is brought, by the aid of a steam-pump, into pipes which carry it to the city.

The water from the tubular wells is brought into the collecting reservoir by the action of a syphon.

Besides the great artesian wells with twenty shafts, there are similar ones having only eight shafts.

Special arrangements are made for repairs, for drawing water from each tubular shaft, for the purpose of special analysis, and for eventually closing the pipes which give bad water.

The great conduit is made of cast-iron; the joints laid in india-rubber.

System of Water-Closets, etc.—In Leipzig the old system of cess-pools has been replaced by tanks and English water-closets. The tanks are of two kinds—fixed and movable. The fixed tanks are emptied by means of an air-pump provided with an apparatus for burning mephitic gases, similar to that used in Paris. The closets are placed in a separate wing, the basement of which is occupied by the tanks.

Fig. 153 shows how the movable receptacles are arranged and the various methods of changing them, the Heidelberg system, as constructed by Friedrich Glass. The ventilating-pipes for the closets are carried above

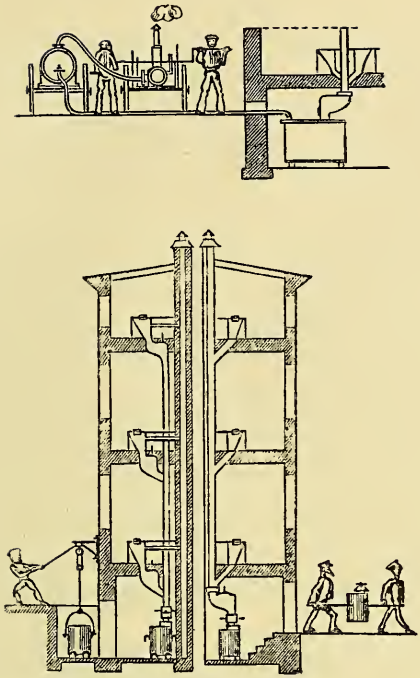


FIG. 153.—CLOSETS WITH MOVABLE RECEPTACLE (HEIDELBERG SYSTEM).

the roof; on the left side of the figure the closets have what the Germans call *Separatkothverschluss*, that is, each pan has a special trap for the excrement, and is ventilated by a pipe opening into a separate shaft. The right side of the figure has only one, *Centralkothverschluss*, that is, a central trap below, the five pans being ventilated by the discharge-pipe.

Neither of these systems is free from bad odours, and water-closets have therefore been adopted in good houses.

In order to prevent the pollution of streams, the excrement must not be removed until the solid parts have been precipitated and disinfected. For this reason the various methods of chemical purification may be studied in Leipzig.

No general system is formally prescribed, but each must be examined and approved before it can be applied in practice.

These different systems are distinguished from each other by the composition of the disinfecting mixture, and the manner in which it is brought into contact with the excrementitious matter.

With some modifications the disinfecting mixture is composed of lime, chloride of magnesium, and carbolic acid or coal-tar.

The Süvern mixture, as it is called, used in the great hospital of St. James, is prepared in the following manner: 42·5 kilogrammes of quicklime are slaked with 102 kilogrammes of water in a trough. During the

slaking it is mixed with 8·5 kilogrammes of coal-tar, and the same amount of chloride of magnesium dissolved in an equal quantity of water. This mixture looks like hasty pudding; it is diluted with water when used.

In the latrines with troughs in use in hospitals, schools, barracks and prisons, the disinfecting mixture is poured into the closet at the rate of half a kilogramme for each person per day; enough water is then added to make the solid substances float; the walls of the troughs are also coated with the disinfectant.

The bottom is provided with a plug and handle, which close the opening of the discharge-pipe. Early every morning the trough is emptied by opening the plug; the excrement and the disinfectant mixture flow into a reservoir, where the solid parts settle, and the liquids pass into the sewers. In private houses, the dejecta are conducted directly by the flushing into a reservoir placed in the yard containing the disinfecting mixture. This reservoir is provided with a plug, the mixture is discharged into a collecting well, where the precipitated substances settle and the liquid escapes.

It is not poured directly into the sewers, but passes first into a well for inspection, from which workmen belonging to the sanitary service take a sample occasionally to see whether the liquid gives an alkaline reaction. If this happens, the disinfection is considered complete; if otherwise, the quantity of the disinfectant has not been sufficient and the offender is liable to a fine.

This method of disinfection is perfectly efficacious. The samples put into bottles closed in the ordinary way have undergone no alteration during several years.

The disinfecting reservoirs for the water-closets of private houses are usually emptied once a week, the plugs opened, and the contents discharged into the well, another supply of the disinfecting mixture being immediately thrown into the reservoir. The collecting wells are not emptied oftener than once in a year or eighteen months, according to their size, which is usually from 30 to 40 cubic mètres. The deposit is principally composed of carbonate of lime mixed with insoluble organic refuse.

The disinfecting action of the Süvern composition is explained as follows :—

By the action of the microbes on the excrement, carbonic acid and ammonia are produced. Each microbe is then surrounded with carbonic acid gas, which combines with the lime, and the microbe is embedded. This can only take place in the fluid parts and at the surface of the solid matters; within the solid matters decomposition continues with evolution of carbonic acid, which breaks up the solid excrement and forms new incrustations.

The disinfecting mixture does not hinder the development of the spores, but, on the contrary, the organic mixture aids in their development into bacteria. This process is, however, accompanied with the evolution of carbonic acid, and thus the destruction of the spores is brought about by the same process as that of the microbes just explained. The ammonia

combines with the chlorine produced by the decomposition of chloride of magnesium.

From the hygienic standpoint, this method is valuable, for the solid matters are rendered perfectly inoffensive, and the liquids might be poured into the smallest stream without any nuisance.

It is, however, only efficient for excrement and household refuse. The attempts to apply it to the waste of breweries and refineries have not succeeded, for the residuum of sugar does not decompose readily, and it is impossible to keep the impure water in contact with the disinfecting mixture long enough for the breaking up and disinfection to be accomplished. It is the same with the sanguineous water of slaughter-houses.

The system of Friedrich and Glass is much in vogue at Leipzig, as well as that of Süvern. The disinfecting mixture is a powder slightly damped, and it is put into a zinc vessel, the sides of which are pierced with holes. The zinc vessel is either placed in the water-closet cistern (*Centralruhrapparat*) or in a receptacle placed in the collecting-well (*Centraldruckruhrapparat*).

Friedrich calculates the quantity of his mixture necessary for a closet used by ten persons at 42 kilogrammes, costing between five and six marks a year.

He has constructed special apparatus of a similar kind for the purification of the waste water from factories. They differ somewhat, according to the quality of the polluted water.

The apparatus shown in Fig. 154 is recommended for waste water, which is precipitated with difficulty, owing to the small amount of solid matter in it. It is composed of a common reservoir (*Doppelgrube*) with a partition, the bottom being covered with a porous substance intended to retain the mud (*Schlamfilter*) and a row of filters vertically arranged. The disinfecting mixture is enclosed in the vessel (*a*), which communicates with a water supply by an automatic tap. When the foul water is mixed with the disinfecting liquid and has passed through the filters, it flows away purified. In order to be effective, this operation must be performed slowly.

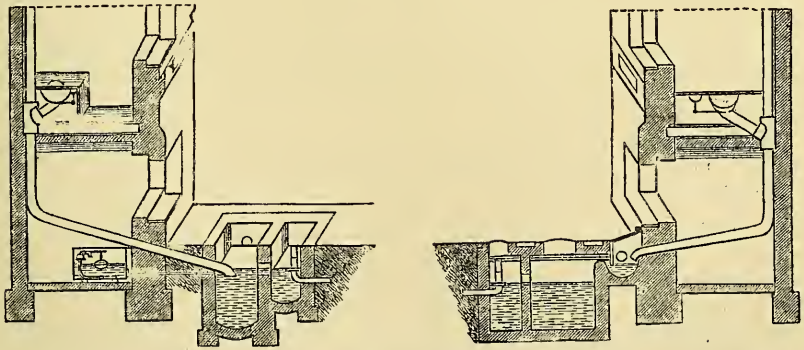


FIG. 154.—COMPLETE VIEW OF THE FRIEDRICH SYSTEM OF DISINFECTION.

The batteries of filters are movable, and may be easily changed.

Fig. 155 shows a purifying reservoir for very foul water, which is

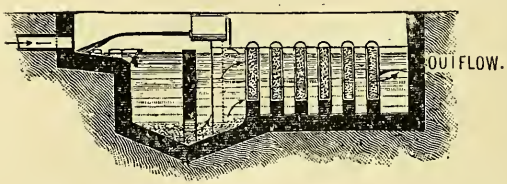


Fig. 155.—Purification of Factory Water (*Doppelgrube Friedrich*).

treated twice with the disinfecting mixture, and should pass through several filters. Large pieces of refuse are retained at the bottom of a sieve.

Abattoir.—The abattoir in Leipzig is a model establishment of it kind. It is situated at the end of the city behind the Bavarian railway station and near the railroad in order to facilitate the transport of the cattle and the removal of the refuse.

The ground has a surface of 115,000 square mètres. The site is elevated and airy, with a good slope. The abattoir itself is arranged in a similar way to the markets, with a sufficiently large space for the slaughtering. The ground is covered with cement and slopes towards the centre, which is traversed by a trench, along which the sanguineous water flows away. Before it reaches the sewer this water should be passed through a series of graduated sieves, which retain the morsels of flesh and fat.

For disinfecting purposes only large quantities of water are used. The intestines are carried away in barrows, and deposited in a place paved with stone having a slope. A tolerably large opening is in the centre of this yard. A tunnel runs below, in which a waggon can move which is placed under the opening; the contents of the stomach and intestines are emptied into this waggon and taken away soon after the slaughtering.

Rails of iron run along the ceiling of the abattoir, into which hooks on pulleys are fixed for the meat. The latter is subsequently taken to adjoining depôts provided with refrigerators.

The blood is collected in galvanized iron vessels, and is used in the preparation of albumen and manure.

There are special abattoirs for small cattle and pigs. Melting-houses and places for the preparation of the offal are also attached to the establishment.

Hospitals for Isolation.—For the isolation of infectious diseases the city has built twenty-two blocks, situated on an extensive site, at the end of which rises the great hospital of St. James.

These blocks are under the same administration as the hospital, and together constitute the clinique of the university.

Each section is directed by a professor.

The blocks reserved for cholera and small-pox are placed at a great distance from the others, and surrounded with a fence, which prevents all unnecessary communication.

There is room for 24 patients in each. The older blocks only contain one ward, the more recent are divided into two parts by a partition without a door.

At one end is a covered verandah for the staff and the convalescents. At the other end are placed the latrines, bath-rooms, and apartments for the nurses.

Heating is effected by means of stoves with jackets heated by coal or gas; ventilation is provided by the windows and skylights.

The blocks are built with squares of wood filled in with bricks. They have no ceilings. The wood-work of the roof is painted in oil inside, the walls are painted, and the floor is of oak.

The latrines are arranged according to the Süvern system, with tubs as described above. Water from the lavatories, the bath-rooms, and kitchen, is carried away by the same pipe as the excrement. On its way the water mixes with the disinfecting substance, which adheres to the sides of the pipe.

This mode of disinfection is found perfectly satisfactory.[1]

A separate building has been erected for the purpose of collecting the sewage, near the centre of the ground, comprising three reservoirs for purification, in which the solid substances can be precipitated, while the liquids flow through a fourth reservoir, and are afterwards poured into the drain. The mud deposited at the bottom is brought by pumps to a platform containing a filtering apparatus of large gravel above the fourth reservoir. The liquid passes through the filter into the reservoir and thence flows away.

The precipitate consists of carbonate of lime mixed with insoluble organic substances. It is greyish in colour, inodorous and aseptic.

Attempts have been made to utilize this substance as manure, but they have not been successful. The calcareous manure is of no service until it has been mixed with the earth for a long time. In its sanitary aspect it is perfectly innocuous.

Samples of the disinfected water have been preserved in the Hygienic Museum, in flasks closed with the ordinary stoppers, for 10 or 15 years without any change. The only change is that the oldest of the flasks have lost half their contents by evaporation through the the stoppers.

The linen of the patients is steeped in a tub containing a 5 per cent. solution of carbolic acid, then taken to a steam laundry reserved for infected linen. It is plunged into a large boiler and heated for half an hour in water with plenty of soap. The laundry, kitchen, and bake-houses are each model establishments of their kind.

Special carriages are used for the transport of the sick.

[1] In other establishments the waste water being taken directly to the common reservoir does not become thoroughly mixed with the disinfectant; decomposition takes place and occasions a serious nuisance. The cause of this must be sought for in a law of physics, according to which the layers of liquid have the property of material repulsion, and do not mix for a long time.

AUSTRIA.

CHAPTER I.

SANITARY LEGISLATION.

General Remarks.—Sanitary Administration.—Sanitary Legislation.—Foods.—Legislation for Factories.—Insurance of Workmen against Accidents and Sickness.—Regulations for the Prevention of Infectious Diseases.—Vaccination.—Protection of children of tender age.—Certification of Deaths.—Burials and Burial-places.—Mortuaries, Removal of Bodies.—Regulations for Buildings.

General Remarks. — The Austrian monarchy is composed of two principal parts: one including the provinces of the Crown, with a separate representation and administration; the other the kingdom of Hungary, and the provinces attached to it, with an organization independent of the first.

The different provinces are inhabited by very dissimilar nationalities of unequal intellectual culture.

The provinces of the Crown have as representatives: the Imperial Council (*Reichsrath*), the members of which constitute the two chambers, the Lords (*Herrenhaus*) and the Deputies (*Abgeordnetenhaus*).

The particular interests of the different provinces are represented by the Diets (*Landtage*); the administration is entrusted to special committees (*Landesausschüsse*).

A governor, or president (*Statthalter*, or *Landes-Präsident*), represents the government; each province is divided into districts (*Amtsbezirke*, or *Bezirkshauptmannschaften*), having each a chief called *Bezirkshauptmann*.

Towns of a certain extent administer their own affairs under the direct superintendence of the governors.

The Hungarian provinces are represented by the Diet of Hungary (*Magnatentafel* and *Repräsentantentafel*); the kingdoms attached, Croatia and Slavonia, have their own Diet (*Landtag*). Sanitary institutions are not the same in the two divisions of the Empire. In several provinces of Hungary it has not been possible to establish a regular service of public hygiene because of the backward state of the people.

The high rate of mortality in the provinces of the Crown also proves decisively that the sanitary régime is far from answering to the requirements of the present day.

The rate of mortality per 1,000 inhabitants was—

In 1870–1874	32·5
„ 1875–1879	30·6
„ 1880–1884	30·4
„ 1880–1888	29·4

The following pages are devoted to the sanitary organization of the provinces of the Crown only.

Sanitary Administration.—*Gesetz 30th April*, 1870.—The head of public hygiene in Austria is the Minister of the Interior; all its affairs being submitted to him by a *Sanitätsreferent*, who is a doctor of medicine.

In very important cases the Ministry asks advice of the higher Sanitary Council, *Oberster Sanitätsrath*, composed of at least six ordinary members chosen by the government from the principal doctors in the capital. They bear the title of *Obersanitatätsrath*, upper councillors of health, but have no fixed salaries, being paid by fees. The Council chooses its own president and vice-president. Additional members may be added if necessary. The governor of each province of the Crown (*Kronland*) has his own referee (*Sanitätsreferent*) and his provincial council of health (*Landes-sanitatätsrath*), composed of from three to six ordinary members chosen by the government, and two members elected by the representatives of the province (*Landesausschuss*). In case of necessity, additional members may be called to assist in the Council.

These functions are honorary, no salary being attached to them. The Council of Health collects statistics relating to hygiene, and presents a report every year, accompanied by proposals made with the intention of improving the sanitary régime.

In the different districts (*Bezirkshauptmannschaften*), the interests of public hygiene are confided to the direction of a doctor, *Bezirksarzt*, who has nearly the same duties as the Kreisphysicus of Prussia.

The State superintends the general direction of the sanitary service, and is responsible for general measures relating to the public health, while special arrangements devolve on the Communes.

The following services are regulated by the State: superintendence of the staff and sanitary inspection, snperintendence of hospitals, asylums and places for vaccination, bathing and hydropathic establishments, for the opening of which a special authorization from government is required; the application of the laws concerning infectious diseases, endemic diseases, epidemics and quarantine; the sale of poisons and medicine; vaccination, forensic medicine and burials.

The Communes take charge of the streets, roads, markets, places for public meetings, habitations, sewers and their cleansing, drinking-water, foods and the vessels which contain them, public baths; they also build and inspect mortuaries, places of burial, cattle markets, etc., and obtain medical care and relief in cases of accident or confinement, take care of foundlings, idiots, deaf-mutes, etc.

The Communes are also bound to carry out the measures prescribed by the administration for the prevention of infectious diseases, and to see that the sanitary regulations are enforced. They must render regular accounts of their proceedings.

Sanitary Legislation.—There is no sanitary law in Austria more complete than that of the 30th April, 1870, which has been already men-

tioned. Some of its arrangements which relate to public hygiene form part of the penal code. The right of making sanitary regulations compulsory throughout the Empire belongs to the Reichsrath; administrative orders of less importance are issued by the government; those embracing the duties of the Communes are authorized in the provinces of the Crown by the local administration.

Foods.—By the terms of the penal law, the use of all poisonous substances in the preparation of food is forbidden, and they must not be used in the glaze for kitchen utensils or drinking-vessels.

The same law punishes the sale of the flesh of animals which have not been inspected. The inspection of meat is strictly organized in Austria; it is performed by special inspectors who superintend the slaughter of the animals, the flesh of which is to be exposed for sale; the beasts must be examined before and after slaughtering. There are two inspectors; one a veterinary surgeon (*Wundartz*), the other chosen by the Commune.

The animals intended for killing, which come from a distance, are put under inspection for ten days; all meat brought from another place must be submitted to inspection. The inspectors of meat have also the oversight of butchers' shops. A special course of study is designed for the inspectors of meat in the veterinary schools.

According to an order (*Hofkantzleidecret*) of the 16th January, 1875, all adulteration or moistening of wheat is forbidden; according to an older decree (*Regierungsdecret*, 15 *July*, 1831), the corn must be free from ergot.

An order of July, 1794, forbids the sale of bread in low, damp, and badly ventilated places; the bread must be well baked, and must not contain any hurtful ingredients.

The penal code forbids all contamination of wells or rivers when their water is used as drinking water.

Legislation for Factories (*Gewerbeordnung* 15*th March*, 1883, *and* 8*th March* 1885).—The Austrian law divides factories into two classes, the free and the licensed. The licensed include those which might become nuisances to the neighbourhood. They cannot be opened without the permission of the competent authority, who may prescribe certain conditions, or refuse the application.

Children must not be employed as apprentices in these trades before the age of twelve years, nor in factories before the age of fourteen years. Young girls between fourteen and sixteen must only be employed in work which will not injure the health nor hinder the free development of the body. Children must attend school regularly.

The working day must not exceed eight hours for children under fourteen years; for adults it may be eleven hours, not including the time for meals and recreation.

Women and children under sixteen are not allowed to work between 8 p.m. and 5 a.m.

A woman must not return to work in the factory for four weeks after her confinement.

Work on Sundays is forbidden without a special authorization from the Minister of Trade.

The communal authorities, the district doctor, and the inspectors of factories are required to watch that these laws are carried into execution.

The inspection of factories is entrusted to fifteen inspectors for the district, with a head-inspector. They must keep a journal, prepare a report of all their work, and present these reports to the head-inspector, who will make a summary of them, give advice on questions relating to the hygiene of factories, and send in a report to the Ministry of Trade.

Insurance of Workmen against Accidents (*Gesetz vom* 28 *December*, 1887, *betreffend die Unfallversicherung der Arbeiter*).—The National Assembly of Austria has adopted a law which makes insurance of workmen against accidents compulsory, as in Germany. The Austrian law is similar to the German, only differing in certain particulars. In Germany the trades within certain defined districts are classified according to the degree of danger incurred by those who are employed in them, and in such instances the insurances are classified in a similar manner.

In Austria there is generally a public institution for insurance in each province of the Crown, with tariffs, graduated according to the gravity of the danger incident to each occupation. In Germany the workmen pay two-thirds of the premium, and the employer one-third; in Austria the workmen only pay 10 per cent., and the employer is responsible for the remaining 90 per cent.

The rates for the premiums are prepared by the insurance company, and ratified by the government. The Minister for the Interior raises or lowers the premiums, according to need, at the time of closing the accounts. He also, assisted by a competent council (*Versicherungsbeirath*), superintends the general system of insurances, the inspection of which belongs to the governments of the different provinces.

Insurance of Workmen against Sickness (*Gesetz vom* 30 *March*, 1888, *betreffend die Krankenversicherung der Arbeiter*).—All persons who are insured against accidents are obliged to be members of a relief office for cases of sickness.

Medical care, medicines etc., and 60 per cent. of the daily wages, are given to all workpeople. Women, in addition, receive pecuniary assistance for four weeks after their confinements. When death takes place, a sum equal to twenty days' wages is given towards the cost of burial, if the day's wages do not exceed $3\frac{1}{2}$ marks.

If the wages are higher, the assistance in illness must not exceed 75 per cent., and must not be continued for more than a year.

The premium to be paid by the workman must not be more than 3 per cent. of the daily wages, and the employer must pay a third.

The circles of operation for the relief offices correspond generally with the judicial districts (*Gerichtsbezirk*).

The district offices of a province of the Crown form a kind of corporation (*Verband*) the administration of which is committed to the company for

insurance against accidents, and organized according to its special arrangements. By this means provision is made for uniformity of action on the part of all offices situated in the same district.

In Austria, as in Germany, the members of the local offices are not bound to join the Central District office when no advantage would thereby be gained on either side.

Regulations for the Prevention of Infectious Diseases.—The regulations established for the prevention of infectious diseases are comprised in four orders, which include—

I. Instructions for doctors in times of epidemics.

II. The regulations prescribed for the examination and collation of reports on epidemics.

III. Instructions on the measures to be taken by the administration of each district (*Bezirkshauptmannschaft*); by the local authorities; by the clergy, and by the officers of health.

IV. Instructions for the inspectors of health (*Sections commissaire*).

i. *Instructions for doctors in times of epidemics.*—The doctor entrusted with this service is bound to take every means for discovering when and how the disease declared itself, and make a complete report of the information he obtains. During the prevalence of the epidemic, he must send regular reports on the progress of the plague, and the measures taken to prevent its spread: when it has ceased, he must make a summary of the former reports, show the result of the measures employed, and propose improvements for the future.

ii. *Regulations Prescribed for the Examination and Collation of Reports on Epidemics.*—The superior authority must examine reports sent in by doctors, in order that the necessary measures may be taken for remedying the defects which are indicated in them.

If there should be a deficiency of doctors, nurses, or hospitals, it must be provided for without delay.

It must be ascertained that all possible preventive means have been taken. If neighbouring localities should be threatened, the necessary arrangements must be made quickly.

iii. *Instructions in the Measures to be taken by the Administration of each District; by the Local and Communal Authorities; by the Clergy, and by the Officers of Health.*

When an epidemic is imminent, the authorities must take measures for—

1st. Preventing the outbreak of the disease.

2nd. Discovering as soon as possible whether it has begun.

3rd. Ascertaining with certainty its nature and intensity.

4th. Procuring all necessary care for the sick.

5th. Hindering its propagation.

6th. Examining the reports received.

7th. Drawing up reports for the superior authority.

If there is no doctor on the spot, one must be called in as quickly as possible in order that he may make the necessary arrangements.

The duty of directing and superintending these measures devolves on the district doctor (*Bezirksarzt*); the authorities and the Commune are obliged to put all the sanitary offices needed at his disposal, and the communal doctor (*Kreisarzt*) is entrusted with the direction of the prescribed measures.

iv. *Instructions for the Sanitary Inspectors.* Inspectors must frequently visit the squares, streets, yards, houses and lodgings in their district, and direct special attention to—

(*a*) The presence of refuse in the squares and streets;

(*b*) The condition of yards, houses, etc., as to cleanliness;

(*c*) The sanitary state of lodgings, etc.;

(*d*) The presence or absence of sick persons;

(*e*) The circumstances of the inhabitants, that it may be ascertained whether any of them are in want of necessaries.

(*f*) The wholesomeness of foods.

When the inspector has the power to immediately remedy any defects which he observes, he should do so, otherwise he must inform the authorities.

The sanitary inspector has also the oversight of the trade in food in markets and shops; he must search out the causes of disease and death, direct disinfection, superintend the burial of bodies, and ascertain that the doctor's orders are obeyed.

There are special and detailed regulations for small-pox, cholera, the plague, and yellow fever, which contain also minute directions concerning quarantine.

Vaccination.—Vaccination is not generally compulsory in Austria, except during an epidemic of small-pox, but the State exerts itself to induce the people to adopt it. According to an order of the 28th February, 1817, all who desire admission into a public school, or to obtain a scholarship, must produce a certificate of vaccination.

Protection of Children of Tender Age (*Hofdecret, April* 1, 1824).—The charge of watching over deserted children devolves on the district doctor (*Bezirksarzt*) and on the pastor of each parish. These persons are bound to inspect the children at nurse frequently, to inform the Relief Board (*Findelhausverwaltung*) of any irregularities which they may have remarked, and to draw up an annual report, which must be sent to the governor.

The regulations are not the same in different provinces of the Crown; in Bohemia, besides the doctor and the pastor, another person is chosen by the Commune, the *Waisenvater*. In Moravia prizes are awarded to the foster-mothers who have taken the greatest care of their children.

Registration of Deaths (*Verordnung* 1 *August*, 1766. *Erlass 2nd March*, 1861).—The burial of a corpse before the death has been officially registered is forbidden. All deaths must be notified immediately to the authorities. For this purpose each Commune nominates a *Beschauer* who must be a doctor or a surgeon (*Wundarzt*), whose duty it is to examine

whether the person be really dead, whether there is any evidence of violent death, and whether death was caused by infectious disease.

When there is the least suspicion that death is only apparent, recourse must be had to the proper means for restoring animation, and the certificate of death must not be given until decomposition has commenced.

If the deceased person has been under medical care, the doctor must make the declaration of death and send it to the registrar, who will see that disinfection is carried out, if the certificate or any other circumstance indicates that the person has suffered from infectious disease.

The details relating to the examination of corpses are entered in a separate register.

Burials and Burying Places (*Verordnung* 23 *August und* 9 *September*, 1784. *Erlass*, 3 *October*, 1870).—In ordinary cases burial must not take place earlier than forty-eight hours after death. Burial in churches is forbidden.

A family vault must not be built without special permission. Cemeteries must be situated at a distance from houses, and buildings must not be erected in their neighbourhood. Graves must be 1·80 mètres in depth, 1·20 mètres wide, and be separated from adjoining graves by 1·20 mètres.

Graves must not be used a second time within ten years, and no house must be built on the site of an old cemetery for the same length of time.

Mortuaries and Removal of Bodies (*Verordnung* 7 *March*, 1771. *Erlass* 18 *März* 1866, 3 *August*, 1871, *und* 3 *Mai*, 1874).—Mortuaries should be built near churches and cemeteries, to which the dead may be removed, especially those belonging to poor families, who have but little room, and persons who have died from infectious diseases.

Bodies must not be kept in the mortuary more than forty-eight hours without an order from the doctor.

The removal of a corpse from one place to another is not permitted without an official authorization, given on the authority of a doctor. In making the removal, hygienic regulations must be observed, the execution of which will be superintended by a sanitary officer.

Regulations for Buildings.—Each province of the Crown has its general regulations for buildings, to which the details of the local regulations must conform.

The most important regulations are as follows :—

New houses, and houses which have undergone extensive repairs, must not be inhabited until they have been inspected by competent persons, delegated by the communal authority, and declared satisfactory from the sanitary standpoint.

Latrines must be so built as to give free access to air and light.

Depôts for manure must be placed at a safe distance from wells, and should have a watertight floor.

The house must be connected with the sewer where one exists, and the connecting-pipe must have a good fall.

A ministerial order of the 27th November, 1884, forbids the use of lead pipes for drinking water in houses, and recommends iron pipes or lead pipes lined with tin or sulfurè.

Factories must be provided with a water-closet and urinal for every fifty workmen.

CHAPTER II.

VIENNA.

General Remarks.—Sanitary Administration.—Sanitary Legislation.—Regulations concerning Buildings.—Sanitary Organization.—Sanitary Arrangements relating to Air.—Sanitary Arrangements relating to Water.—Foods.—Sanitary Arrangements relating to the Ground.—Sewers.—System of Scavenging.—Stables.—Cattle Markets.—Abattoirs.—Preventive Measures against Infectious Diseases.—Vaccination.—Compulsory Registration.—Isolation of Patients.—Disinfection.—Mortuaries.—Cemeteries.—Prostitution.—Hospitals.—Dwellings of Workmen.—Hygiene of Factories.—Hygiene of Schools.

General Remarks.—The gay capital of Austria covers a surface of 55 square kilomètres and has 800,000 inhabitants. It is situated on the south bank of the Danube, one arm of which is close to the city—the Donaucanal. If the numerous suburbs are included, the city has an extent of 155 square kilomètres and the population is 1,250,000.

Vienna occupies a tolerably level plain, bounded on the south by hills of considerable height. The north side is traversed by the Donaucanal, the south by the little river Wien, which falls into the canal.

The city is divided into 10 districts (*Verwaltungsbezirke*), and administered by the Municipal Council (*Gemeinderath*), the president of which is the Burgomaster. Ordinary business is managed by a magistrate chosen by the Municipal Council. He exercises the executive and administrative power, and is called the *Director*. The different districts are ruled by commissions (*Bezirksausschüsse*), presided over by the chief of the district (*Bezirksvorsteher*).

Sanitary Administration.—Public hygiene is directed by a Council of Hygiene (*das magistratliche Sanitäts-Departement*). Medical functions, properly so called, are exercised by the Medical Bureau (*Stadtphysicat*), composed of a chief doctor (*Physicus*), with his assistant and 13 district doctors (*Bezirksarzte*), each with two assistants.

The district doctors are entrusted with the direction of public hygiene, being assisted by the sanitary inspectors (*Sanitätsaufseher*), by porters for the sick and watchers by the dead. The rescue service, the means of transport for the sick, are also under their care, as well as the measures for the prevention of infectious diseases, for the occurrence of which they must attentively watch; vaccination must be superintended by them, also the welfare of children put out to board; they have the oversight of midwives, dentists, and inspectors of the dead, bathing establishments, and shops for the sale of mineral waters.

Buildings and sanitary institutions are also under their inspection.

Private doctors are attached to the police service, for rescue work and prostitution; and to the Relief Board for the care of the poor.

An office for statistics (*Statistisches Departement*) is attached to the Municipality, which publishes a detailed report every week, including meteorology, the level of the subsoil water and of the Danube, the density of the population (sexes being distinguished) according to the area and number of houses in each district, marriages and births (legitimate, illegitimate, and still-born), a table of births; one of deaths, with their causes, for some of the great cities in the country, and some foreign ones; deaths grouped according to age; still-born (legitimate and illegitimate); the number of cases of sickness, which must be separately notified for each district; the supply of provisions and a statement of their price.

Sanitary Regulations concerning Buildings (*Gesetz* 15 *Januar*, 1883).—Sites for building must have such a form and dimensions as to ensure sufficient light and air for the houses. The streets must be laid out as nearly as possible in a straight line, and have a uniform slope. Their width must not be less than 16 mètres. The Commune is bound to construct public sewers, to which the owners of houses must bring their drainage.

All plans for buildings must be submitted to careful examination with regard to the hygienic arrangements. The approved plans must always be at hand for the use of the foremen during the carrying out of the work, who can thus see that the work is executed in accordance with the plans. No contractors must be employed except such as are approved by the administration, who must be responsible for the good quality of the material employed, and for the soundness of the work. Any change of architect or contractor must be announced to the commission for buildings.

When houses have rooms or staircases lighted from above, suitable arrangements must be made for ventilation. In general the height of a house must not exceed 25 mètres; the floor of the last storey must not be more than 20 mètres above the level of the street. When the ground slopes, this measure must be taken from the highest point. The house must not have more than five storeys, including the cellar and the attics.

Each room must receive light direct from the sky, and be properly ventilated; no room must be less than 3 mètres in height.

The size of courts depends on the situation, extent, and height of the buildings; on the situation of neighbouring courts, the number of rooms opening on the court, and the uses to which they are applied. Courts must not be too small, or the supply of air and light will be insufficient for health.

The areas near a wall of the house or a kitchen must have at least 12 square mètres of surface; those which light corridors or water-closets, 6 mètres.

Ventilating-shafts for latrines must have a section of at least 1 square

mètre, and like the areas must communicate with the yard or the street by means of openings of sufficient size to ensure ventilation.

As a general rule no floor must be less than 15 centimètres above the level of the street and the yard; but if sanitary prescriptions are carefully observed, a room may be built below this level.

All places in the basements not used for habitation must nevertheless conform to sanitary requirements. Stables must be drained, and the floors constructed in such a way that the walls and ground cannot be fouled.

Manure-pits must be watertight, and be provided with a close-fitting lid. They must be placed as far as possible from wells and habitations.

Drainage of houses and grounds must be effected by means of conduits of large dimensions (*Hauscanale*), or by discharge-pipes of smaller size.

The conduits must be oval, 0·60 mètres in width and 1·05 mètres in height, perfectly watertight and either constructed of brick jointed with hydraulic mortar or of cement. The fall must be as great as possible.

The discharge-pipes are of glazed earthenware set in cement, or made watertight in some other way.

The branch-pipes must have a diameter of 18 centimètres; the principal pipes should be of proportionate size, and so constructed as to prevent obstructions.

Drainage-pipes should be placed as far as possible from wells.

In general the laying of pipes under rooms is not permitted. Where it cannot be avoided they must be surrounded with a bed of cement 15 centimètres in thickness, and the openings must be arranged so as to allow of easy access to the pipes.

All the pipes of a house must be ventilated by means of ventilating-shafts reaching to the top of the roof, and placed in the chimney if practicable.

In those quarters of the city where any other arrangements than water-closets are permitted, they must conform to the regulations of the Commission for Buildings. The place used for latrines must be 90 centimètres in width, 1·10 mètres in length, and be properly lighted and ventilated. The discharge-pipe, which must not be made of wood, must be carried to the top of the roof, and be of the same diameter throughout.

In those quarters which have a water service, the building of water-closets inside the houses is enforced. Closets outside must be provided with a flushing apparatus if possible. In all quarters to which the water service extends, all new buildings and reconstructions must be connected with it by a special branch for each house. In those parts which have not the water service each new estate must be provided with water in some other way. As soon as the distribution reaches their quarter, owners are bound to connect it with their houses.

The fixing of a gas-meter in a living-room is forbidden. A new house, or one rebuilt, must not be inhabited until it has been ascertained by inspection that the work has been well executed, and that the house is dry and healthy.

Sanitary Organization.—Sanitary Arrangements relating to Air.—As far as the construction of the buildings is concerned, Vienna is not a very healthy city. In 1809 it was still surrounded with a double line of fortifications, which have been destroyed to make room for immense building sites and two wide circular streets: one the *Ringstrasse*, forming the interior circle, encloses the old city; the other, *Gürtelstrasse*, takes in the old suburbs. The narrow and tortuous streets, the crowded houses of the old quarters, remain as memorials of past times.

Probably the historic associations connected with this state of things have impeded the carrying out of the arrangements suitable to present needs, which are embodied in the new building regulations of 1883. These prescribe that courts must conform to hygienic conditions as to their size; but this rule is set aside by the paragraph which permits 85 per cent. of the surface of a site to be covered with buildings. Consequently the state of the rooms which open on the yard and the air within them is so far from being satisfactory that one hesitates to open the windows.

The city of Vienna is remarkable for its high mortality from tuberculous diseases, which reaches 26 per cent. of all the deaths. Impure air affords the most favourable conditions for the spread of these diseases.

The state of Vienna may serve as a warning to other localities, prompting them to use the most efficacious means for combating these evils, arising from a deficient supply of light and air for the houses.

Within the circuit of the city, Vienna has only a small number of parks and open spaces: the *Volksgarten*, the *Hofgarten* and the *Stadtpark*, situated near the Ringstrasse, and the *Augarten* in the quarter named *Leopoldstadt*.

The suburbs include magnificent promenades, among which the *Prater*, *Schoenbrunn* and *Kahlenberg* occupy the first rank.

Ventilation is generally organized as in Germany; sometimes however the arrangements are original; the system adopted at the Grand Opera House and the hospital *Rudolf-Stiftung* is particularly interesting. They were both built by Professor Boehm, who enjoys a great reputation in this department. At the Grand Opera ventilation is effected by inspiration and aspiration. The apparatus for inspiration is put in motion by a steam engine of 16 horse-power; the openings for air are placed in the garden; the air is brought by two subterranean pipes to the bellows, which drive it into a room, whence it passes by three pipes into a chamber heated with steam-pipes. The air is then distributed into the hall (pit, boxes, etc.). Beside the pipes for heated air, other pipes for cold air are placed so that the two kinds of air can be mixed when necessary. This mixture is effected in the inspecting-room situated on the ground-floor, by means of a regulator. Electric conducting wires, connected with thermometers placed in the hall, show in this room the temperature which prevails in the different parts of the theatre.

The impure air escapes from the galleries and ceiling by means of pipes which open into a great common shaft above the lustre.

At the hospital of Rudolf-Stiftung, the heating and ventilation are managed by stoves of earthenware placed in the halls. These stoves have a jacket in order to warm the fresh air entering from outside. The impure air is carried out by pipes opening near the ceiling, which surround the smoke pipe and rise with it above the roof.

The discharge-pipes have also openings below the roof, furnished with valves for ventilation in summer. The fresh air enters directly by openings made in the wall near the ceiling, and by the windows.

Sanitary Arrangements relating to Water.—Since 1874 Vienna has been supplied by two great sources: that of *Kaiserbrunnenquelle* and *Stixensteinerquelle*, situated in the Styrian Alps at a height of 2,000 mètres above the level of the sea. The water is brought by two aqueducts in masonry which unite near Termitz, forming only one aqueduct to Rosenhugel, near Vienna, where it is received into a great reservoir. From Rosenhugel the water is brought into the city by means of two conduits, one leading into a reservoir called *Schmeltz*, near the north-west border of the city, which holds 38,808 cubic mètres. The other, the *Wienerberg*, at the south-west, which holds 17,509 cubic mètres. A pipe from the last is connected with a third reservoir, the *Laaerberg*, situated near the centre of the city, holding 22,986 cubic mètres.

All the reservoirs are placed at such a height that the water can flow into the houses of the city by simple gravitation.

The aqueducts from the mountains to Vienna are about 100 kilomètres long; the supply of water is not the same in winter as in summer, the quantity varying between 25,000 and 114,000 cubic mètres a day. It has therefore been necessary to procure an additional supply during winter, and a special supply has been obtained on the bank of the river Schwarza, near the station of Pottsbach.

It consists of 5 wells 10 mètres in depth, having a diameter of 6 mètres, which are dug in land bought for that purpose and turned into a park. The water is brought from the wells by pumps, and joins the aqueduct which brings water from the mountains.

These wells deliver 16,800 cubic mètres of water per diem. This additional quantity is however insufficient, and works have been undertaken for the purpose of lengthening the conduits from the mountains and digging new wells of great depth so as to provide against any possible failure of the supply of water from the mountains.

A municipal order of the 1st November, 1880, forbids the use of leaden pipes for the water service in the houses, and authorizes the employment of lead pipes lined with tin.

Foods.—The oversight of the trade in provisions belongs to the magistrate, who appoints for that purpose a certain number of agents (*Markt-Commissariat*), whose duty it is to examine the quality of the food exposed for sale in the markets and shops. When any of the provisions are suspected, a sample is taken, which is sent to the Bureau of Hygiene (*Stadt-physicat*) that it may be analysed. Provisions and drinks which are tainted

or adulterated are immediately confiscated and destroyed. The city does not yet possess a laboratory, and the samples are analysed by two private chemists on behalf of the Communal Authority.

Establishments for mineral waters are visited every year by the district doctors and the inspectors.

The wholesale market for provisions is called the *Grossmarkthalle.* Retail sales are made in six smaller markets situated in different quarters of the town. Some of these have been recently built, according to the rules of hygiene, in masonry and glass; the ground is covered with asphalte, they are well supplied with water, and include a cellar, an ice-house, a room for the inspectors, an office for weighing, latrines, etc., etc.

The market is open to the public from six in the morning till noon.

Sanitary Arrangements relating to the Ground.—Paving and Repair of Streets.—Removal of Refuse.—The streets and public places occupy a surface of about 5 millions of square mètres, nearly 3 millions being paved with stone: 75,000 asphalted, 6,000 paved with wood, and the rest macadamized. At the standing places for public carriages the joints of the stones are filled up with asphalte.

Before paving, a bed of gravel 15 centimètres in thickness is laid on the soil, which is afterwards covered with 3 centimètres of sand.

For the macadamized streets a foundation of flints or pebbles 30 centimètres thick is first laid, on which the crushed stone is spread to a height of 16 to 24 centimètres, the whole being then well rolled with a heavy roller and watered.

Two-thirds of the streets are watered every day during the hot season. In the central part of the city the cleansing is performed in the night by means of mechanical brushes. The more distant quarters are swept by hand in the day time.

The refuse of the houses and yards, as well as the sweepings of the streets, are carried away by waggons.

Sewers.—Some of the sewers in Vienna date from the 14th and 15th centuries, but the greater number have been constructed in this century.

The want of unity in the system of sewers thus constructed is less felt here than it would be elsewhere, because the ground presents favourable conditions. The ground on which the city is built is divided by four valleys traversed by streams: the Alsbach, the Waehringen Bach, the Ottakringer Bach, and the Wien, which empty into the Danube canal.

The three first are made into covered canals, which serve as common sewers; the Wien is still uncovered, but it no longer receives the sewage from the interior of the city, which is carried away by special canals, dug on each side of the river, and named *Choleracanales*, because they were constructed after the ravages of the cholera from 1831 to 1834.

There are other sewers besides these natural outlets. The Danube canal, into which all the sewage of Vienna is brought, is 47 mètres wide, and has a fall of 0·39 centimètres per kilomètre. Notwithstanding this considerable mass of water and the rapidity of the current, the canal be-

comes so polluted during the summer months that it is proposed to bring the sewage directly to the Danube outside the city by means of sewers constructed along the two banks.

The fall is irregular in the old sewers; it varies from 2·20 mètres and 17·40 mètres per kilomètre; in the smallest, called the *Brigittenau*, in the lowest part of the city, the fall is only 1·70 mètres. The height of the sewer is 2 mètres and it is 1·05 mètres in width.

The sewers of the second rank have usually a good fall of 6·90 mètres and the common street sewers have usually the same fall.

In form and structure the sewers of Vienna present several types differing according to the time of their construction. The oldest have a flat bottom and vertical sides; more recent sewers have a concave floor and are circular; finally, those built after 1872 are oval. Their height varies from 0·60 mètres to 1·50 mètres with a width of 0·60 mètres to 1·10 mètres. The new ones are made in cement, with walls 22 centimètres in thickness.

The cleansing of public as well as private sewers is in each district the business of persons engaged by the municipalities. All the pipes are cleaned during the night once a month; the deposit brought up at the openings is taken to the canal, where it is collected into casks, which are towed down the river that they may discharge into the middle of the current.

The inconveniences, inseparable from the want of unity in the system, have decided the authorities to have a plan for reconstruction prepared, which will be more in accordance with the needs of our time.

Night-soil.—After careful examination of this question, Vienna has decided to make the construction of water-closets compulsory in those quarters which have a distribution of water. In the others movable tanks are used.

Stables. — Cattle Markets.—Abattoirs.—All cattle brought to Vienna must be accompanied by a certificate of health (*Viehpass*), and they must be examined on their arrival by the veterinary surgeons of the city.

Stables must be kept perfectly clean, and be sufficiently ventilated. The keeping of pigs is forbidden.

The great cattle-market (*Central Viehmarkt*) was built in 1880–83. It cost nearly 3,200,000 marks. The market is divided into two parts by a street; on one side are horned cattle and calves, on the other sheep and pigs. The stables are near the places for sale. The market for the sale of horned cattle, *Rinderhalle*, is 114·40 mètres in breadth and 152·50 mètres in length. It is covered by a roof of sheet-iron supported by iron pillars. The front façade has walls in masonry with glass windows; the other sides are open. There is room for 4,000 head of cattle, and the stables can accommodate 2,140 more.

The market for calves *Kalberhalle* is a closed building containing 5,588 square mètres. It can accommodate 4,500 calves.

The sheep-market, *Schafhalle*, also covered, includes a space of 4,024

square mètres and contains 6,000 sheep. At the side are open inclosures which can hold 14,000 sheep.

The market for pigs, *Schweinehalle*, is 156 mètres in length, and 100 in breadth; 8,800 animals may be kept in the pigsties beside it.

The ground is paved throughout. Water-posts, placed wherever needed, furnish an abundant supply of water. The manure is taken away every day.

There is an abattoir near the cattle market resembling those which have been already described.

The *städtische Wasenmeisterie*, situated in the suburb Kaiser Ebersdorf, may be considered an abattoir.

According to Austrian law each Commune is bound to build and maintain an "*Aasplat*," that is, an establishment to which diseased animals can be taken for slaughter and subsequent disposal. For this purpose the authorities in Vienna have expended the sum of 240,000 marks in building a model establishment near the Donaucanal.

The carcases are destroyed by the thermo-chemical current, all the parts which can be utilized being collected. This establishment is composed of a large building the middle of which contains rooms for habitation; the right wing includes stables, coach-houses and store-rooms for forage, the left wing more stables for the beasts intended for slaughter, and a room for cutting up healthy animals (*Schlagbrücke*), also store-rooms for the prepared products and drying-rooms. In an opposite wing are placed: a room for the steam-boiler; a scalding-house for the carcases of diseased animals, and another for healthy animals; a tool house, and a room where the workmen change their clothes.

The floor of all these rooms is covered with asphalte; the walls are lined with cement and polished to the height of 2 mètres; each place is provided with a water-post. The carcases are cut up and cooked in vessels called *digesteurs*; the fat is separated. The liquid matters are used to make glue; the flesh and bones are pressed, dried, and made into manure.

If the slaughtered animal is not diseased, the skin, hair, horns and hoofs are preserved.

The carcases of diseased animals which cannot be utilized at once are put into pits and covered with lime.

Preventive Measures against Infectious Diseases.—Vaccination.—As previously stated, there is no regular compulsory vaccination in Austria. But when an epidemic of small-pox is threatened, all persons are obliged to be vaccinated and re-vaccinated, and the State does everything possible to facilitate the carrying out of vaccination by the Communes.

Vaccination is performed gratuitously during the summer in the different arrondissements by doctors belonging to the police and the Relief Board.

The first vaccine is taken from calves; afterwards vaccination is done from arm to arm.

Vienna possesses four bureaux for vaccination (*Impfsinstitute*), three of

which are private and the fourth subsidized by the State. They all supply animal vaccine, and the sanitary condition of the calves is under the care of a veterinary surgeon.

Compulsory Registration.—Isolation of Patients.—The doctor is bound to notify every case of typhus, dysentery, small-pox, scarlet fever, measles, diphtheria, purulent ophthalmia, whooping-cough, erysipelas, puerperal fever, hydrophobia, and trichinosis, which occurs in his practice. On receiving this notification the district doctor at once sends the inspector under his orders to the dwelling of the patient in order to examine the case notified.

The district doctor also directs the measures which should be taken for the rest of the family and the patient himself, isolation of the patient, removal to the hospital, vaccination, disinfection, attendance at school and business.

When disinfection has been performed, rigorous measures may be discontinued, but teachers and pupils belonging to families suffering from infectious disease are not permitted to rejoin their companions until they have received a certificate from the district doctor stating that disinfection has been performed by a competent sanitary inspector.

There are no hospitals for isolation at Vienna, but there are special pavilions for infective diseases in connection with the general hospitals. Near the hospital Rudolf-Stiftung a hut has been constructed of painted canvas mounted on wooden frames, the floor being formed of a bed of cement laid on the ground.

Disinfection.—Carbolic acid is the disinfectant generally used in Vienna. Walls, floors, and furniture are washed with a solution of 5 per cent.; before washing the linen is steeped twenty-four hours in the same solution. From 2 to 5 per cent. of carbolic acid is put in the water in which patients suffering from scarlet fever or small-pox have bathed before the bath is emptied. In cholera, typhoid fever, dysentery, diphtheria, and scarlet fever, the latrines are disinfected every day with the pure acid; after typhus and cholera, if the district doctor considers it necessary, the walls of the infected places are scraped, and coated with white-lime coated with 5 per cent. of acid. Fumigations with sulphur are also frequently used. After a place has been fumigated in this way it must be thoroughly ventilated and purified.

Articles which cannot be washed are disinfected with steam. Every arrondissement of the city keeps a movable disinfecting stove for this purpose, the one on the Thursfield system being reproduced below.

This apparatus is composed of a cylindrical stove with double casing, the intermediate space forming part of the boiler. When the water is heated, the heat is communicated to the stove and prevents the steam from condensing. This apparatus is easily managed, and one man can move it. In order to make it act, the boiler is filled by the funnel *C* up to the height marked by the indicator, the fire is lit, the articles are then placed in the disinfector, and the apparatus is closed. When the steam

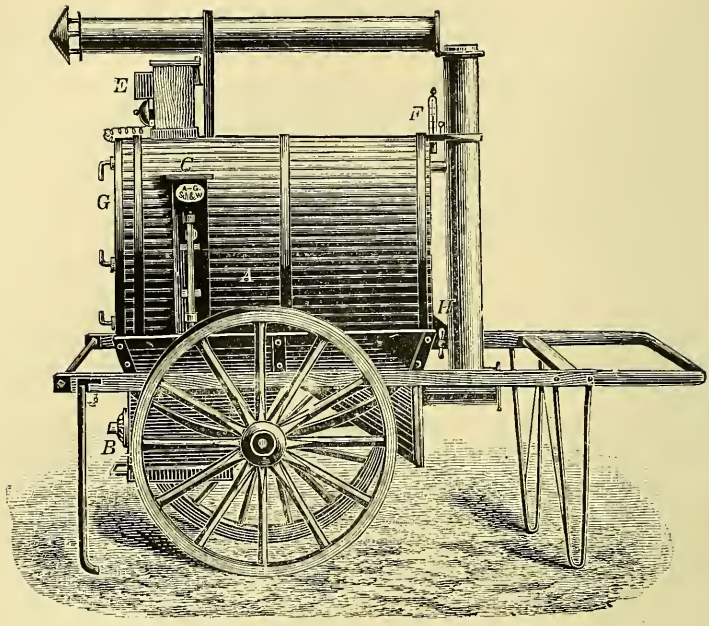


FIG. 155A.—THURSFIELD'S DISINFECTING STOVE.

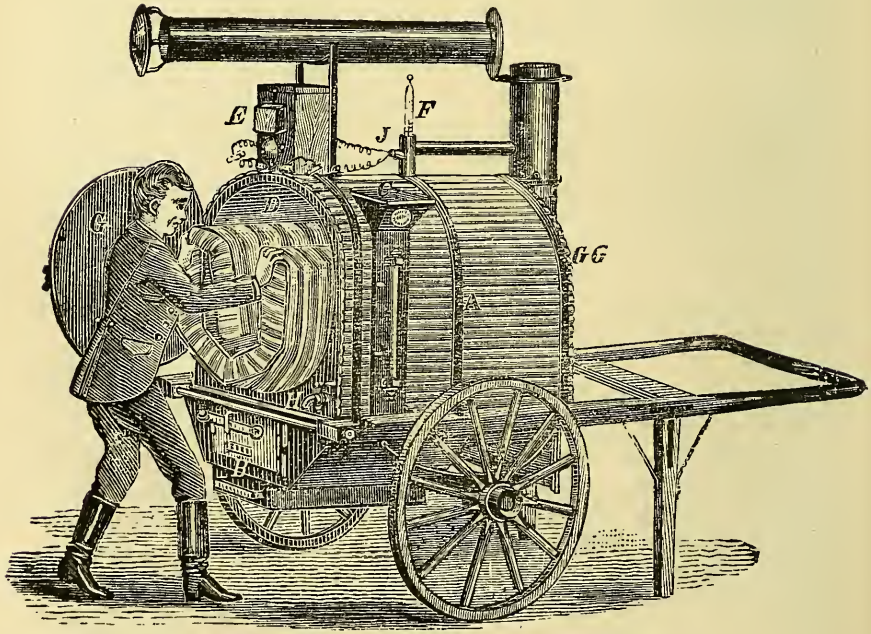


FIG. 155B.—THE SAME DISINFECTING STOVE.

begins to rise, it is conducted to the bottom of the stove and escapes near the top by an opening furnished with a thermometer.

Disinfection is complete in thirty minutes, this time being considered sufficient for the destruction of bacteria and spores. Cold water is then poured into the boiler, which cools the apparatus so that the articles can be taken out, and they dry rapidly in the open air. The price of this stove is 540 marks.

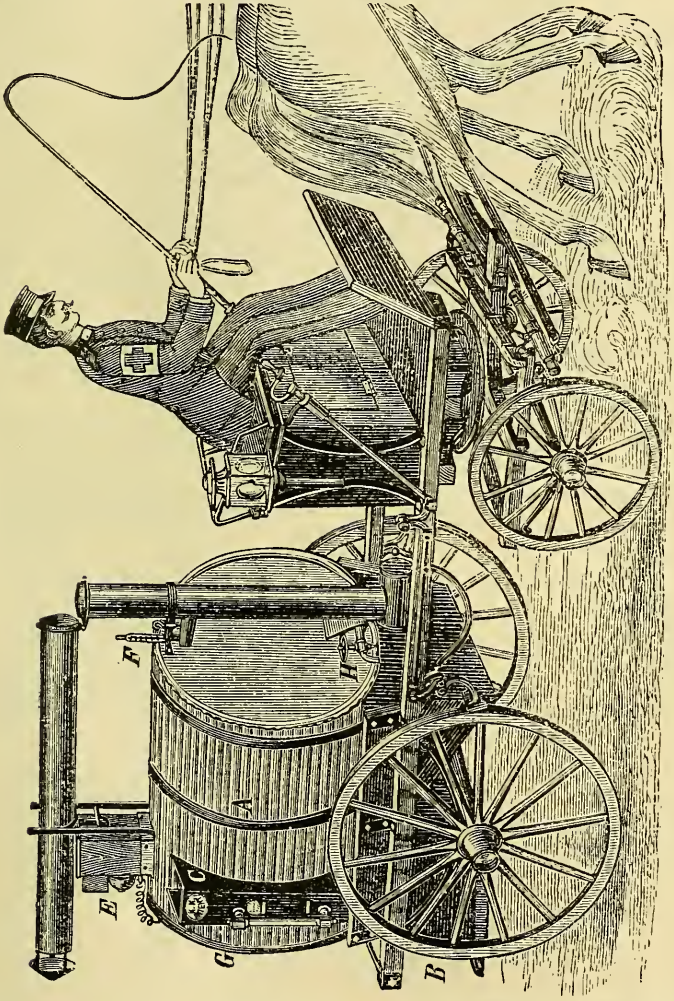


FIG. 156.—THURSFIELD'S MOVABLE DISINFECTING STOVE.

Fig. 156 shows a large stove which is moved by horses, Fig. 154 a simpler form mounted on trestles. This apparatus is in great demand because of its simplicity. It only costs 400 marks and will hold an entire set of bedding, or from 10 to 15 suits of clothes. It may be used 10 or 11 times a day.

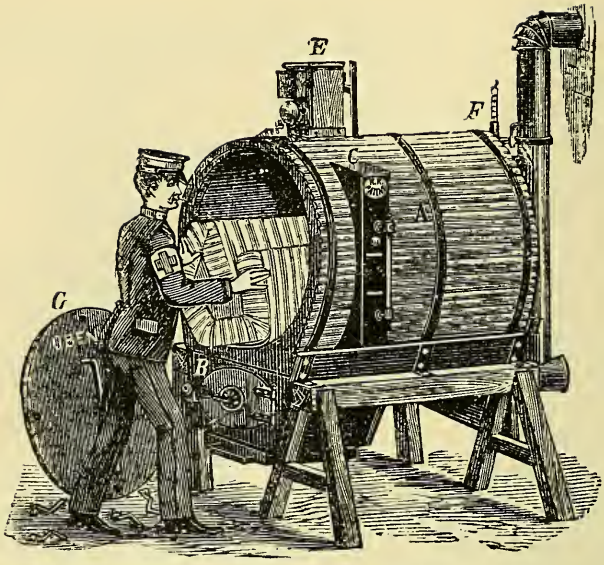


FIG. 157.—THURSFIELD'S FIXED DISINFECTING STOVE.

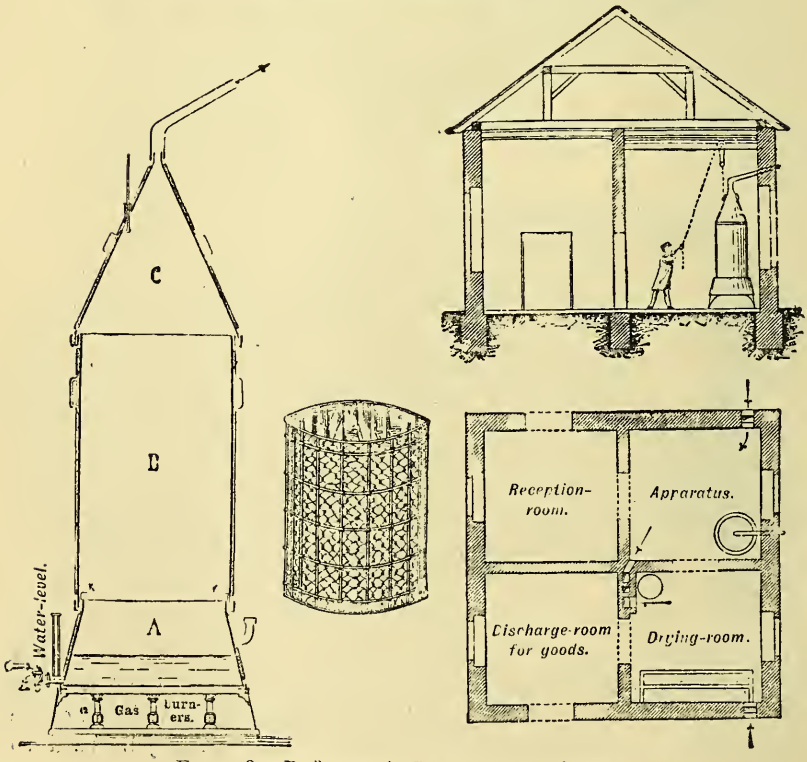


FIG. 158.—BRÜCKNER'S DISINFECTING STOVE.

Another kind of disinfecting apparatus used in Vienna is constructed by the engineer Brückner.

This apparatus, shown in Fig. 158, was not invented in Austria, the celebrated Professor Koch first used it in his laboratory at Berlin. The idea was afterwards taken up by Flügge, who applied it on a larger scale; it was then introduced into Vienna. It is composed of three principal parts: the boiler *A*, made of copper is placed at the bottom, above is the disinfecting chamber; *B*, formed of galvanized iron, with an isolating layer; above is the cover *C* with a discharge-pipe for the steam and a thermometer.

The clothes are put into a wire basket lined with cloth. This basket

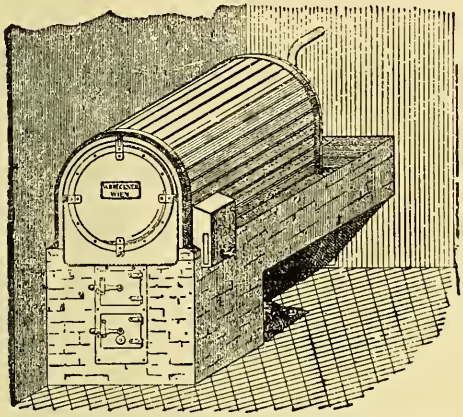


Fig. 159.—Brückner's Disinfecting Stove, Heated by Wood.

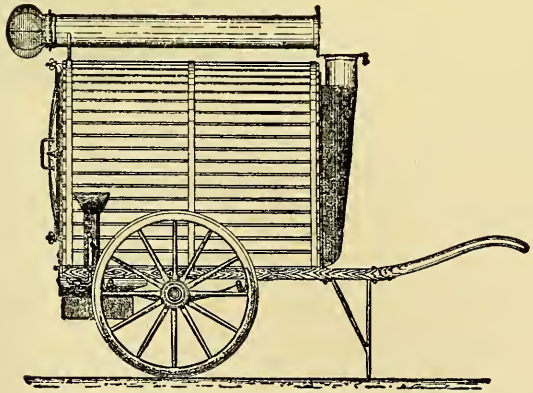


Fig. 160.—Brückner's Movable Disinfecting Stove.

does not touch the sides of the chamber, so that the condensed steam cannot drop on to its contents. This apparatus is heated by gas. For heating by wood or coal Brückner has constructed the same apparatus in

a horizontal position (Fig. 159) and mounted on wheels, as represented in Fig. 160.

Mortuaries.—Cemeteries.—There is a mortuary for each district of the city (*Leichenkammer*), to which are brought corpses belonging to families who have imperfect accommodation.

The district doctor must decide whether removal is necessary, as it is his duty to register deaths and their causes. He should at the same time examine into the state of the dwelling from the sanitary standpoint.

In all cases of sudden death, and when the cause of death is not apparent, a *post-mortem* examination must be made.

The bodies of persons who have died from infectious diseases must not be taken to the common mortuaries, but to the one built in the cemetery.

Bodies must not be buried within the city. The principal cemetery (*Centralfriedhof*) is at Kaiser-Ebersdorf, north-west of the city, erected at a cost of about 4 millions of marks.

Prostitution.—Women who are notorious as prostitutes are registered and examined twice a week. The inspection is made at the doctor's house and the cost is defrayed by the Commune. Each woman has a pass-book in which the visit is marked. If she is found to be diseased, her pass-book is withdrawn and she is sent to the hospital.

There are no houses registered for vice in Vienna.

Hospitals.—There are three hospitals in Vienna (*Das allegemeine Krankenhaus*, *das Krankenhaus*, *Wieden* and *Krankenanstalt Rudolf-Stiftung*).

The first dates from the year 1784. It has been greatly enlarged, and there is an average of 38 cubic mètres of air-space for each patient.

The heating and ventilation are managed by stoves with casings, openings made in the walls near the ceiling which can be shut at will, and ventilating-pipes crossing the roof.

The cells for isolation, intended for insane men, have a central heating system combined with ventilation.

In the hospital Wieden there is an average of 32 cubic mètres of air for each patient. Heating and ventilation are the same as have just been explained. These two hospilals cannot be regarded as models.

The third, Rudolf-Stiftung, fulfils hygienic requirements more completely although the wards are not isolated and only have windows on one side.

Ventilation is organized in a satisfactory manner, as simple as original. It has already been described (p. 424).

Dwellings of Workmen.—In Vienna there are only a small number of houses specially built for workmen in the Favoriten quarter. These houses are built in stone with several storeys, having a central corridor in which are placed the water-closets.

As the system of flushing the closets was not introduced in 1887 the air cannot be pure. But cleanliness and order are maintained by the careful supervision exercised by the authorities.

Hygiene of Factories.—The hygiene of factories in Vienna is managed according to the regulations in force throughout the Empire, which have been already described (p. 416).

Hygiene of Schools.—Some time after the adoption of the new law for primary schools, a decree of the 9th June, 1873, gave to the public all the details of the regulations relating to the hygiene of schools.

As these are very similar to those already given in this volume, we shall only notice those which are mentioned in the Austrian law.

The site chosen for the school must not be definitely accepted until the doctor has given his opinion as to the suitability of the land from the sanitary standpoint. The plan must then be examined by a commission, composed of men skilled in teaching, in technology, and in medical hygiene.

The class-rooms on the first storey must be at least 80 centimètres above the surface of the ground; if possible, the windows should look towards the south-west. The upper part of the window should move on a horizontal axis or be arranged in some way which will ensure good ventilation. A scraper or a mat should be placed at the bottom of each staircase and at the entrance to every class-room.

The rooms must be warmed by a central heating apparatus, or by stoves with jackets, earthenware stoves being preferable. If made of iron, there must be two casings of this, with an intermediate space of 3 centimètres. The stoves must be kept locked.

The doors and windows of the class-rooms must be opened in the interval between each lesson, but there should be other methods of ventilation which can act continuously. They should be managed so that a sufficient quantity of pure air, warmed in winter, may enter, and the impure air be expelled without draughts.

During the hot weather doors and windows should be open if the current of air is not too strong; or in this case apertures must be arranged in the side of the wall opposite the windows.

In cold weather the air should be renewed by means of stoves communicating with the fresh air by a pipe of sufficient size and the vitiated air should be carried off by ventilating-pipes of the same diameter, the air in which is heated by being connected with the stove, and the pipes being carried up above the roof.

Each class-room must be provided with a thermometer placed at a height of 1·20 mètres to 1·50 mètres above the floor. The temperature should not exceed 18° to 19° Centigrade. If it falls below 16°, the rooms must be heated a little, whatever the season may be. Each master is bound to see that ventilation is efficiently carried out.

The class-rooms, staircases, and corridors should be swept and dusted carefully every day. The whole establishment must be washed from top to bottom at least four times during the year; the walls must be white-washed in the holidays. Care must be taken that the windows are always quite clean.

Each school must be provided with washstands in order that the pupils may wash their hands frequently.

The pupils should have as little work as possible to do at home. No work must be given between morning and afternoon school.

Mental work must alternate with physical exercise, and towards the evening lessons should be so arranged as to demand less mental exertion from the scholars.

Teachers must attend to the cleanliness of the children. An inspection must be made from time to time, and those who are dirty sent to wash.

Children must acquire the habit of attending to the calls of nature during the times for recreation; they are not absolutely forbidden to go out in study time, but this permission must not be given to more than one pupil at once.

Masters are expected to understand the principles of public hygiene, and to apply them in their schools; they should also use their influence in the families to procure for the children wholesome diet and good physical education. They should do everything in their power to secure the development of mind and body at the same time.

In every commune, district and province of the Crown, there are scholastic authorities entrusted with the supervision of schools in concert with the sanitary authorities.

In every district there is also a permanent Commission of School Hygiene which forms part of the School Council; one of the members must be a doctor. It is his duty to give advice on sanitary questions and to remedy any defects reported to him. He should regularly visit the schools in his district and send in an account of the results of his inspection, also proposing any improvements he may consider desirable.

SWEDEN.

CHAPTER I.

SANITARY LEGISLATION.

General Remarks. Sanitary Administration.—Medical Council.—Provincial Doctors for Districts and Towns.—Sanitary Service for Communes.—Statistics.—Health Commissions.

Sanitary Legislation.—General Regulations Relating to Hygiene in Towns.—General Regulations relating to Hygiene in the Country.—Regulations Concerning Epidemics and Infectious Diseases.—Regulations for Persons in Quarantine.—General Arrangements.—Laws Respecting Vaccination.—Laws for Factories.—Police Regulations for towns.—Regulations for Buildings.

General Remarks.—The mortality in the united kingdom of Sweden and Norway is lower than in any other European country: 17·2 per 1,000 inhabitants. This happy state of things must be attributed as much to the more elevated tone of civilization and morality in the nation as to the excellence of its hygienic institutions.

The Swedish people have been free from remote antiquity, and this independence has formed a vigorous and serious race with quick moral perceptions. A healthy climate, a fairly just partition of property, the absence of excess of population, and the compulsory assistance given to the poor, all contribute to the maintenance of a good social hygiene.

In Sweden, public hygiene has always been included in the subjects entrusted to the medical administration. Nevertheless it has occupied a secondary place, while other branches of medical science have developed rapidly, and some of them have attained a leading position in science. It is only since 1890 that the study of hygiene has been made compulsory for medical students; the University of Stockholm is still the only one which possesses a chair for that science. However, since 1874, Sweden has had a sanitary code which is faithfully observed because of the general culture of the population. When instruction in hygiene is more widely diffused, this country will become the model of a perfect hygienic *régime.*

Sanitary Administration.—**Medical Council** (*Instruktionen, 2nd November*, 1877).—The superintendence and inspection of the public health are exercised by a special authority, the Medical Council (*Sundhetscollegium*). This is composed of a general director and four members, of whom three, councillors of health (*Medicinalråd*), have the charge of civil affairs. The fourth, the chief army surgeon, directs military affairs. The director and the other members of the Council must hold the degree of doctors of medicine.

The Council has a chancellor's office and a room for accounts.

The duties of the Medical Council are as follows :—

1. To supervise the public health and the treatment of the sick throughout the kingdom ; to direct the business of the medical administration of the country.

2. To furnish information and assistance, when requested, to the tribunals, state and communal authorities, and other functionaries of the State.

All the institutions which belong to public hygiene, and the care of the sick, such as vaccination, the staff of doctors, midwives, dentists, surgeons, barbers, veterinary surgeons, apothecaries, medical jurisprudence, asylums, and bathing establishments, are under the immediate direction of the Medical Council.

To fulfil its functions, the Sundhetscollegium is required to give instructions to those requiring it, and special reports in certain cases, as to information obtained on the public health in general, or at the time of the appearance of an epidemic.

The new regulation of the 31st October, 1890, has established in each town a chief provincial doctor as inspector and sanitary statistician to report on hygienic matters to the prefect.

The Sundhetscollegium must give attention to the dangers to health incident to certain professions, trades, etc., etc. In these cases it must propose regulations and other measures proper for the prevention of the evil.

It must watch over the doctors entrusted with the public hygiene, and the care of the sick, in order to see that these duties are performed efficiently.

Whenever it is informed that a Sanitary Commission has neglected to conform to the prescribed regulations, the government must be advised, and good order restored.

When a serious epidemic breaks out, or much sickness occurs, it may appoint assistant-doctors, who will help in the care of the patients. It may also propose general measures likely to improve sanitary arrangements and the service of the sick.

The Medical Council is not authorized to issue decrees. Everything which concerns the service of the sick in the army, on land and on sea, should be carefully superintended by the Medical Council, which may take any measures or give any directions it may judge necessary or useful for the welfare of the service.

For this purpose the Council must present regular reports, including the recommendations of doctors having reference to these subjects.

The Medical Council also draws up annual reports on the sanitary state of the kingdom.

Provincial Doctors for Districts and Towns.—Sanitary Service for Communes.—According to the old regulations of 1822, the provincial doctor (*provinciallaekare*) is entrusted with the direction of

public hygiene in his province. He must give attention to everything likely to affect the health of the people. For this purpose he must carefully study the medical topography of his province, the character of the population and their manner of life, rural dwellings, the physical education of children in the country, and the domestic remedies in use. He must take care to give instruction in all these points, and oppose errors. He should pay attention to the quality of foods and drinks, especially when danger to health may be apprehended after a bad harvest, bad weather during harvest, or other circumstances. In such cases he will report the state of things to the governor of the province in order that energetic preventive measures may be taken.

On the notification of venereal disease, the provincial doctor is bound to discover the origin of the malady if possible, and to send such patients as cannot be treated at home to the hospital.

Vaccination is also directed and superintended by the Provinciallaekare. Midwives and apothecaries are subject to his control. Medical jurisprudence is also within his department.

Besides the provincial doctors nominated by the government, there are also district doctors for the country (*Distriktslaekare*), who have the charge of the sanitary service of one or several Communes. They should perform the same duties as the provincial doctors.

Towns have special doctors, whose duties are the same as those of the district doctors.

Each Commune is bound to organize and superintend hygiene in its territory. Each town must have a Commission of Hygiene (*Helsovårdsnämnd*); in rural Communes the Communal Council is entrusted with sanitary functions.

Statistics.—The pastor of each parish registers the births and deaths, and sends the register to the provincial doctor, who draws up tables of statistics, and despatches them to the Medical Council with his annual report. The Council makes a summary of all these reports which is sent to the government.

Health Commissions.—These have been organized by the Code of Hygiene of the 25th December, 1874, and the Amending Code of the 6th November, 1885.

The Health Commission (*Helsovårdsnämnd*) is composed of the head of the police, or, failing him, a member of the municipality connected with the police; a municipal judge, chosen by the burgomaster and aldermen; the municipal doctor; and, lastly, four members elected by the Municipal Council.

The members are elected for four years.

There are as many deputy members as elected members. They are nominated by the Municipal Council or by the assembly of electors. They perform their duties in turn, according to the number of votes which they obtained at the time of the election. Persons who have been condemned for felony, or have lost their civil rights, etc., are ineligible.

In case of necessity, the Commission may add to their number suitable persons, who have a consultative power, but no vote.

The Commission chooses its president and vice-president annually; it meets regularly once a month, and also whenever circumstances require. Meetings are also held at the request of the head of the police, or of two members; also when desired by the communal or prefectoral administration.

The Commission has charge of everything relating to the public health and hygiene in its district; it should make a study of everything likely to influence health, or to improve the sanitary condition of the district; and should act as a kind of sanitary police. The municipal police must help the Commission in the exercise of its duties, and give information about any insanitary state of things which has come under their observation.

The Health Commission may sub-divide the district, and employ an inspector to superintend the application of hygienic measures in each of the sub-divisions. Application is made by the Commission to the Municipal Council for the necessary grants of money, and it disposes of the subsidies voted, subject to the general regulations of the Municipal Council.

The Commission may summon any citizen to appear before it, and refusal is punishable with a fine. The Commission may call in the assistance of the police authorities to compel the attendance of the required persons.

The orders, which contain explicit directions, and not merely advice and warnings, must be carried into effect by the chief of the police. He may refuse to execute the order if he judges it to be contrary to any public regulation. If the Commission should persevere in its opinion, the matter must be referred to the superior authority of the Royal Prefecture.

The other orders are executed in conformity with special regulations.

The Municipal Council can charge the Commission with the administration of hospitals, and the care of the indigent sick.

Sanitary Legislation.—General Regulations Relating to Hygiene in Towns.—Every town must be provided with water of good quality for drinking, domestic purposes, and the flushing of streets and sewers.

The sewers must be so constructed as to admit of the rapid discharge of the water from the streets and houses.

Wet or marshy land in towns or their vicinity must be drained.

Night-soil, refuse, mud, etc., are removed in such a way as not to occasion any nuisance.

If an increase in the death-rate should occur in one or more places, the Health Commission must inquire into the causes. It will then take measures for removing them, if possible. If the municipality should refuse to execute the measures recommended by the Commission, the matter is referred to the Royal Prefecture, and to the superior Council of Health (*Sundhetscollegium*).

Every year, in the month of March, the Commission sends to the superior Council of Health its report on the sanitary state of the district during the preceding year, also on the working of the hospitals and the care given to the sick poor. A table of mortality is sent with this report.

A cemetery must not be placed within the boundaries of a town.

Sandy or calcareous soils are to be preferred for cemeteries. The land should be carefully drained and planted with trees, the water must not be allowed to pollute spring-water or wells, or any parts of a town, or village.

A body must not be buried in a church or chapel unless it is embalmed and placed in a perfectly sealed metal coffin.

In cemeteries burials must not be made in a grave previously occupied until fifteen years have elapsed. When the ground has been sold to private persons, the interval may be shorter, but in these cases the regulations of the Commission must be strictly carried out.

There must be 1·50 mètre of earth above the coffin.

It is forbidden to let lodgings in a building the sanitary state of which is unsatisfactory. The Commission may order the necessary repairs. The lodging must not be let until their execution has been approved.

The overcrowding of rooms is forbidden.

Provision must be made for frequent change of the air in school-rooms, churches, workhouses, law-courts, theatres, workshops, factories, etc.

The Health Commission must carefully examine the quality of the water for drinking and culinary purposes, and see that wells are so constructed as to be in no danger of pollution.

The pollution of wells or any kind of water-course is forbidden. It is forbidden to expose for sale the flesh of a diseased animal, or any food, whether liquid or solid, likely to endanger health.

The Commission may seize suspected provisions in any public place where they are exposed for sale or prepared for use.

It has the right to take samples, at the average price of the foods, for purposes of analysis, and may forbid the sale of the suspected foods until the result of the analysis is declared.

When an epidemic prevails in one or more places, the Commission may forbid the sale of unripe fruit, or of any kind of fruit it may consider injurious.

Factories of animal manure; phosphates; sodas; hydrochloric, sulphuric, and nitric acids; beet-root sugar; glass-works and potteries; foundries involving the production of sulphurous or arsenical fumes; mills for the crushing of bones; works for the preparation of cod-liver oil; depôts for rags, bones, skins, manure, etc., must not be opened in towns, except in places sufficiently distant from all habitations.

Dye-houses, factories for colours, tanneries, abattoirs, gas-works, starch factories, etc., must be established in those parts of the town where the population is not dense.

Before a factory, etc., can be built, application in writing must be made to the Commission, accompanied with a description of the works projected.

The works must be constructed and conducted in such a manner as to occasion no injury to the health of the workmen, the neighbours, or the public. The Commission has the right to prescribe any measures necessary to promote this end. Unless owners and managers conform to such regulations the works may be closed.

Each house must have a sufficient number of water-closets or privies in the yard or court. They must be at least 6 mètres distant from streets, squares, springs, wells, cisterns, or reservoirs of water.

Privies constructed in houses must have floors impervious to moisture, and movable tanks. The excrement must not be permitted to penetrate the ground, nor be scattered about.

Pigs must not be kept in out-houses which adjoin habitations.

Pig-sties must be kept very clean, and be at least 6 mètres distant from streets, squares, wells, cisterns, etc.

Pigs must not be kept without informing the Commission.

It is forbidden to build stables or cattle-sheds in connection with inhabited houses. The floors of stables and cattle-sheds must be raised above the ground, and have a slope, so that the liquid manure may flow away. It must not flow into streets or yards.

Manure should be removed from the vicinity of houses; the liquid must be made to flow into watertight pits.

The place for manure must be raised above the ground-level; and the pits for liquid manure, stables and cattle-sheds, should be at least 6 mètres from every house, street, place, square, well, etc.

If household refuse, mud, and refuse of the streets, cannot be immediately removed, they must be kept in movable watertight receptacles.

Refuse, night-soil, manure, etc., must not remain long in the towns. The place where they are deposited must be at such a distance from the towns as to prevent any emanations from annoying the inhabitants.

Infractions of the different regulations mentioned are punishable by various fines.

The Commission has the right to make special regulations for the district of which it has the sanitary direction. These regulations are obligatory, like those of the law of 1875; and infractions of them are similarly punishable by fines.

Such regulations must be submitted to the Municipal Council. If they are accepted, the Prefecture must subsequently endorse them.

The Commission has the right to order the execution of the work it prescribes at the cost of the delinquent.

These regulations apply to towns, ports, fishing villages, and other places which have a tolerably dense population.

General Regulations relating to Hygiene in the Country.—Public hygiene in the country is in the charge of the Communal Council. When this Council deals with questions relating to hospitals, and help given to the sick poor, the doctors of the arrondissement and the district have a consultative voice.

The Communal Council has the same duties to perform for the country as the Health Commission for the towns.

In January of every year the Communal Council sends an account of all that has been done in the way of promoting hygiene during the preceding years to the doctors of the arrondissement and the district. The doctors send a report on the subject to the superior Council of Health.

Water must be of good quality, in sufficient quantity, and easily accessible.

It must not be polluted by percolation, or by the overflow of waste or household water.

Houses and their surroundings must always be kept clean.

No trade or industry must be carried on in such a manner as to endanger the health of the workmen or neighbours.

All the regulations for cemeteries are obligatory in the country as well as in the towns.

The Communal Council must see that the regulations relating to hygiene are carefully observed, it may give warnings, and request the Commune to make special local sanitary regulations.

Regulations concerning Epidemics and Infectious Diseases.—When an epidemic breaks out, the Health Commission or the Communal Council must immediately take the necessary measures for preventing its propagation as far as possible.

The medical and hospital services must at once be organized.

Every doctor called in to a person suffering from cholera, small-pox, or other epidemic or infectious diseases, must immediately send the name, age, and residence of the patient to the Commission, specifying also the nature of the disease.

If the cases of illness are isolated, the doctor in attendance must make a declaration to that effect as soon as he is well assured of it. If an epidemic breaks out, the doctor must notify the new cases which have come to his knowledge once a week, on a day fixed by the Commission. If he judges that a patient is not properly isolated, it is his duty to immediately inform the Commission.

During the prevalence of an epidemic or infectious disease, the Commission must attend to the following regulations :—

1. The immediate removal of the patient to a special hospital, or place isolated for the purpose, unless the transport should endanger the life of the patient. He may remain in his own dwelling if he can be nursed according to the regulations prescribed by the Commission.

2. The immediate disinfection of the house, clothing, bedding, etc., of the patients who have died, recovered, or been sent to the hospital.

3. That patients are not removed in public carriages; that stretchers, sedan chairs, etc., are disinfected after use.

4. That the clothing of the patients, and anything belonging to the hospital which has been lent or sold, are disinfected.

Persons suffering from epidemic or infectious disease cannot refuse to be removed to the special hospital unless life would be endangered, or they can be nursed in a place properly isolated at their own expense.

When two infectious diseases prevail at the same time, two special hospitals should be established, or at least a properly isolated portion must be set apart for the treatment of one class of patients.

When no Health Commission exists, the doctor in attendance must inform the president of the Communal Council of any illness, and direct him as to the necessary measures to be taken, and the Communal Council must then carry them into execution if practicable.

Regulations for Persons in Quarantine (*Förordningen, 19th March*, 1875).—Every ship which has had a cholera patient on board, or has put into port with one, or had communication with an infected ship, must hoist a black flag on entering a Swedish port, or, if a black flag is not obtainable, a white one.

On arrival, the ship, passengers, luggage, etc., are inspected. If examination confirms suspicion, the ship is isolated from the land, and from other ships. In the contrary case, no interference is necessary.

When cases of cholera have occurred during the voyage, the healthy passengers and their baggage are released. The ship and crew must be isolated until disinfection has been completed.

If cases of cholera occur at the time of arrival at a port, the patients are removed to a hospital, unless permission to nurse them on board is given by the Health Commission. In the latter case, the ship must be isolated, until it has been disinfected after recovery or death.

The execution of these regulations devolves upon the Commission; failing that, on the direction of the Custom House, or, finally, upon the Communal Council.

If a ship of war, having a doctor on board, is in question, there is no inspection; the ship doctor makes the necessary declarations.

The preceding regulations apply to yellow fever.

The cost of inspection and removal of the patients is defrayed by the ship-owners, the superior Council of Health paying the cost of disinfection.

Infractions of these rules are punishable by fines.

Disinfection must be performed in accordance with the regulations of the *Sundhetscollegium*.

Clothing and bedding may be burned if the Commission or Communal Council consider it desirable, the owners being indemnified.

The head of the police, staff of the Custom House, pilots, etc., must assist the Commission or the Communal Council in the execution of these measures.

General Arrangements.—The prefectoral authorities must watch over the regular working of the service of public hygiene, and see that the Health Commissions and the Communal Councils perform their duties.

Repeated infractions of the above regulations are punished by higher fines.

Every citizen has the right to appeal against any decree, regulation, or order of the Health Commission or the Communal Council, but this appeal does not suspend the execution of the decree, regulation or order.

Fines are paid into the communal chest.

Laws respecting Vaccination (*Regulation of the 27th September*, 1853).—Vaccination has been made compulsory in Sweden since the year 1853. The principal enactments relating to it are as follows:—

(*a*) All natural or adoptive parents, or guardians, must see that the children under their care are vaccinated before the age of two years. This obligation applies to older children, if it is not ascertained that they have had small-pox, or have been successfully vaccinated.

(*b*) In order to be assured that the operation has been successful, the vaccinated patient must be examined by the doctor or the official vaccinator at the appointed times and places.

No one can be admitted into a school or public establishment unless it is certain that he has either had small-pox, or been successfully vaccinated, or that vaccination performed five years before produced no result.

Asylums and orphanages must not give up a child unless it has been vaccinated, a written certificate to that effect being required when the child is surrendered.

The following persons have the right to vaccinate; doctors and surgeons; sacristans and midwives, who can certify that they possess sufficient knowledge to follow the prescribed regulations; persons furnished with certificates given by the doctor, showing that they understand the course of vaccination, its symptoms, and the means by which it is distinguished from other diseases which resemble it, and that they are able to keep the registers of vaccination; persons who have formerly been employed as vaccinators, and have already gained the confidence of the public.

Vaccination may be performed in all towns at any time during the year.

In the country, where vaccine cannot always be obtained, it will be performed at fixed times every year, by preference in the months of May and September, unless there are any local reasons why another time is more convenient.

If small-pox has already broken out, all unvaccinated persons must be vaccinated without delay, at any season, and without distinction of age.

The persons entrusted with the practice and superintendence of vaccination, must recommend it to the public at all times, but especially if there is any small-pox in the locality.

There are special regulations concerning re-vaccination in the army.

No vaccinated person must refuse to give vaccine to the operator if requested.

In order to secure a sufficient supply of vaccine, the State will establish depôts directed by doctors nominated by the Medical Council; it is their duty to maintain a constant supply of vaccine of good quality in their districts.

A central depôt for all the kingdom is always maintained in the city of Stockholm, which is under the direct inspection of the Council of Health.

It is the duty of vaccinators to observe with the greatest attention any symptoms resembling vaccinia in horned cattle. If these appear, he must inform the nearest district doctor at once, who will go to the places in order to be assured whether the reported disease is really vaccinia. If it is so, he will collect vaccine from the animal in order to send it without delay to the Council of Health, with a detailed report of the case.

Parents, guardians, masters, and others having children in their care, are liable to a fine if they do not have them vaccinated within two years after birth; also if they refuse to send older children or servants, who have not been vaccinated successfully at the times fixed.

If this warning is disregarded, it will be followed by a second, with a double fine; if the offender does not then comply with the regulations, the matter will be brought before the Prefect, who will take such measures as are indicated by the regulations in force.

If such negligence or contumacy is shown at the time of an epidemic of small-pox, the double fine will be inflicted at the first warning. If any person who has neglected vaccination is attacked by small-pox, and the infection should be propagated through this unfortunate omission, he will be proceeded with according to law and imprisoned.

Those neglecting to present the patient for inspection after the operation are liable to the same fine, and vaccination must be performed again.

Any one refusing to give vaccine from a patient successfully vaccinated is also liable to a fine, doubled in times of epidemic.

Prefects must see that all parishes are provided with a vaccinator; and the agents of police must give what assistance is in their power for the encouragement of vaccination.

General supervision is exercised by the Medical Council, who will take care that this branch of public hygiene receives attention in all its details.

The Council is bound to give precise instructions on the practice of vaccination to the officers at the vaccine depôts, and to all vaccinators, and to take all measures in its power to promote the progress of vaccination.

Law for Factories.—The regulations relating to this question are reproduced in the hygienic code of the year 1874, and in the resolution of

the 18th November, 1881, relating to the employment of minors in all factories, trades, and professions of whatever kind (*Færordningen angående minderåriges anvaendande i arbete vid fabrik, handtwerk eller annan handtering 18th November*, 1881).

The following regulations are in force :—

All trades which employ workers under age are placed under the supervision of the Health Commission of the Commune in which the factory, workshop, or industrial establishment is situated. The manager must inform the Commission of every new engagement within a month.

The employment of children under twelve years is forbidden ; also the employment of those who have not received sufficient instruction to leave school ; and those who are unfit for work because of bad or feeble health. All persons under the age of eighteen are considered minors, those under fourteen are called children ; between fourteen and sixteen they are called young people.

Children must not work more than six hours a day, and young people not more than ten hours. This time must be included between 6 a.m. and 8 p.m. ; it must be divided by intervals for rest, so arranged that children have half an hour, and young people an hour before 3 in the afternoon.

Minors must not remain in the rooms where they work during the intervals for rest, and they must not be employed in cleaning any machine in motion.

Minors under fifteen must attend the primary school at such times as may be arranged by the School Council after consultation with the manager, unless they receive similar instruction elsewhere. A report of the course followed must be sent to the manager every month.

When a business is very large, the establishment must be considered a factory, and the above regulations applied to it. The Health Committee decides on this matter.

The employment of young girls and children in underground work is forbidden ; mines and quarries are subject to the same regulations as factories.

Trades which endanger health or require excessive exertion must conform to special regulations.

If the usual regulations relating to the hours of work cannot be enforced because of accidents or other circumstances, the Health Commission may sanction the irregularity during four weeks in the course of the year but young girls and children must not work at any other hours of the day than those mentioned above.

When the Commission thinks proper to make this concession to a manufacturer, the Minister of the Interior must be immediately informed. If the favour is requested for more than the month, or for a special industry, the royal sanction must be obtained.

The manager must preserve the certificates attesting the age, degree of education, physical constitution, and state of health of workpeople under

age in his employment, as well as the monthly school reports sent to him.

Regulations must be put up in a conspicuous place in each factory, together with any modifications which may have been made, the hours at which work begins and ends and the intervals for rest being stated.

It is the duty of the Health Commission and the Communal Council to see that regulations are duly observed. For this purpose industrial establishments must be visited by members of the Commission. These visits, with the observations made, must be carefully entered in a note-book, in order that reports may be sent to the Prefect quarterly, who will afterwards transmit them to the Department of the Interior.

When a trade requires special exertions likely to endanger health and in consequence needing special arrangements for the employment of work-people under age, the Health Commission must make a declaration to the Department of the Interior.

Health Commissions, Communal Councils, persons chosen by them, and any additional inspectors who may be nominated by the King to superintend the strict observance of the regulations prescribed by law, have the right of entry to all factories, mines, or quarries, and they may make any examination which the performance of their duties requires.

The fines paid by defaulters revert to the Communal Exchequer.

Other regulations are specially intended to obviate the dangers attendant on the manufacture of matches and similar trades.

Police Regulations for Royal Cities (*Förordning of the 24th March*, 1868, *and 10th December*, 1886).—Sanitary regulations may be summed up as follows :—

The Municipal Council chooses the sites for public markets in the city, decides where different kinds of merchandise shall be sold, and makes such regulations as are necessary for the maintenance of order and cleanliness in places of sale.

Persons who own dogs must conform to the regulations for keeping them within bounds.

The Municipality must assign suitable places where the public may bathe in the open air, wherever it is possible.

Streets, markets, public places, footways, and alleys, must be swept and cleaned at fixed times ; sewers must be cleansed and refuse removed at the times prescribed for the work.

Yards, carriage entrances, and passages must be kept clean.

Persons who undertake the removal of night-soil, manure, or other refuse must use watertight vehicles and vessels, which do not leak on the way ; the receptacles must be properly closed, and not left in public places longer than is necessary.

The municipality fixes times for the removal of manure and refuse of all kinds, adding any instructions which may be necessary.

No refuse, carrion, street sweepings, factory refuse, or other impurities must be thrown into a lake, bay, canal, or stream of water of any kind, nor must they be put on ice.

It is also forbidden to throw such things into a public place ; they must be taken to a distance.

Any person polluting the water of public fountains, springs, or aqueducts in a city or its suburbs is liable to a fine.

These regulations may be applied with suitable modifications to large villages, ports, fishing villages, and other places where there is a dense population, if the Prefect, in conjunction with the Commune should make a decree to this effect subject to the royal sanction.

Regulations for Buildings.—The government has published a general regulation, dated the 8th of May, 1874, intended to serve as the basis of more detailed regulations for the different towns.

This regulation applies to large villages and all other places having a dense population.

A special Commission superintends buildings in towns.

The plan of a town should be made in such a way as to give the inhabitants plenty of light, air, and exercise, with good sanitary conditions. All possible precautions against fire should be taken. Lastly, it should be made pleasant to the eye.

Large esplanades planted with trees should cross the town in several directions, if possible. There should also be smaller clumps of trees and avenues.

Groups of houses must not be arranged in such a way as to offer any obstacles to the renewal of the air. All sites for building must be sufficiently large to allow of well-ventilated yards to the houses.

In all the quarters of the town, places for public gardens must be reserved so as to be near all the houses. It is recommended that trees should be planted in the streets before the houses.

In any case the gardens and courts must not be used for buildings or other purposes, and the owners are bound to keep them in good order.

In all towns the streets must not be less than 18 mètres in width. Streets looking on the esplanade may be 12 mètres wide. When houses have a court in front, the width must be estimated from house to house.

The ground must be carefully levelled and a uniform plan for carrying off the water adopted. This plan must be approved by the authorities before the building is begun.

Before building, the site should be made as dry as possible, and the water diverted in such a manner as not to interfere with the neighbouring site ; no new constructions must be made on ground already used for building of such a nature as to contravene the above regulations.

In every site the court must have a surface at least equal to half that covered by the buildings, and this space must not be less than 180 square mètres. The principal part of the court must be 12 mètres in width, and the other parts, corners, etc., $4\frac{1}{2}$ mètres. Every building overlooking the neighbouring site, which is not built in line with it, must be separated from it by a minimum distance of $4\frac{1}{2}$ mètres.

When two houses have a common court, or one merely divided by a

fence, the part belonging to each need not measure more than 135 square mètres, and may be 9 mètres wide.

If the windows of a dwelling-house look out on a back yard or the neighbouring ground, the width of this yard must not be less than 12 mètres, and the yard may belong to the two tenants in common.

These regulations must be enforced in the old parts of the town as far as possible.

The regulations prescribed by the Hygienic Code concerning privies, stables, cattle-sheds, must be strictly observed in the construction and interior arrangements of buildings, as well as those orders made with the view of obviating the dangers to health incident to certain trades.

A dwelling-house must not have more than five storeys. If attics have stoves, they are reckoned as a storey. The height of the buildings must not exceed the width of the street by more than $1\frac{1}{2}$ mètres; buildings erected within the ground must not exceed in height the width of the court by more than $1\frac{1}{2}$ mètres.

The height of a building is measured from the street to the cornice of the roof. At the corner of a street the angle of the building must be arranged so as to make a levelled or rounded corner.

The outside of a house must not be lime-washed in white or any glaring colour.

The floors of apartments must be at least 30 centimètres above the ground, and the rooms must be at least 2·70 mètres in height.

In examining questions relating to buildings, the Building Commission must see that the proposed buildings are appropriate to the site, and that dwelling-houses are healthily situated and adapted to the requirements of hygiene. It will be necessary also to determine the elevation of every building site in relation to the street, with a view to the drainage.

CHAPTER II.

STOCKHOLM.

General Remarks—Sanitary Organization.—Regulations for Buildings.—Sanitary Arrangements relating to Air.—Sanitary Arrangements relating to Water.—Foods.—Milk Trade.—Sanitary Arrangements relating to the Ground.—Cleansing.—Drainage.—Privies.—Stables.—Abattoirs.—Preventive Measures against Infectious Diseases.—Vaccination.—Isolation and Treatment of the Sick.—Disinfection.—Mortuaries.—Prostitution.—Public Buildings.—Workmen's Houses.—Hygiene of Factories.—Hygiene of Schools.

General Résumé.—The situation of Stockholm makes it one of the most beautiful cities in the world. It is built on the spot where the great lake Mælar enters the Baltic Sea. This lake falls into the sea by three small arms, which form islands on which the old part of the city is built; the other parts cover the shores of the lake and sea, also the large island of Kungsholmen in the lake, some islets of small extent, and the large island of Djurgärden at the entrance to the Baltic.

The ground is very irregular; that part of the land on which the city stands being nearly surrounded by water, the Arstaviken and Hamarbysjön to the south, the Brunsviken and Uggelviken to the north.

The origin of the city dates from the 13th century; it covered in 1889 a surface of 1,700 hectares, and had a population of 225,000 souls.

Important hygienic works have been executed in the course of the last few years, and the good results are apparent as shown by the decrease in the general death-rate.

It has been, per 1,000 inhabitants:—

27·05 from 1875 to 1879.
24·89 „ 1880 „ 1884.
22·01 „ 1885 „ 1888.

Sanitary Organization.—Stockholm disputes with Brussels the honour of possessing a sanitary service better organized than any other of the Continental capitals. In both cities all the matters relating to public hygiene are directed by a Bureau of Health (*Helsovärdsbyrän*), which has for its director the principal doctor in the city (*Forste Stadslaekaren*).

A sanitary inspector is attached to the Bureau (*Sundhetsinspektor*), also a doctor, who is the head of the sanitary police (*Sundhetspolisen*), which is composed of a commissioner and 11 agents (*Sundhetskonstaplar*).

The principal doctor also superintends vaccination, hospitals, prostitution, medical assistance to the poor, forensic medicine, veterinary practice, hygiene of schools, factories, workshops, benevolent institutions, prisons, etc.

He is assisted by a great number of officers. Forensic medicine is entrusted to the doctor second in rank ; the relief of the poor to 14 district doctors (*Distriktslaekare*), vaccination to regularly appointed vaccinators, the inspection of prostitutes to private doctors, and so on.

The construction of private buildings from the sanitary standpoint is the only thing which is not within the department of the Bureau of Health. It is entrusted to a special Commission, thus giving rise to many difficulties. At the express request of the Commission of Hygiene this special Commission takes the advice of the Bureau on all questions concerning hygiene and the sanitary states of houses.

A chemical laboratory is attached to the Bureau for the purpose of making analysis of air, water, soil, and foods.

The principal doctor must present to the medical council every year a report, including detailed demographic and nosographic statistics of the town.

Information on statistics is supplied to him by the agents for statistics (*Rotemaennen*), resembling the English registrars, whose duty it is to note all particulars relating to population.

The chief doctor publishes a report every week containing a table of births, the number of the population, the mortality and sickness in the different districts, specifying sex and age ; that of the week compared with the same week in the last ten years ; the height of the barometer, the temperature, the average rainfall, demographic statistics, the prevalence of infectious diseases as compared with the previous ten weeks ; the principal causes of mortality in several towns in Sweden compared with that in foreign countries (for Finland the town of Abo) ; the number of patients in the hospitals of the capital ; finally, the meteorological conditions for every day of the week.

All important business is transmitted to the Health Commission by the chief doctor, who is one of its members.

The general police is instructed to assist the sanitary police in everything which concerns the observation of these regulations, and to report all infractions of them to the acting Commission.

Regulations for Buildings (*Kungœrelsen of the 20th October*, 1876). —In new quarters of a town every house must have a yard or court as directed in the general regulations for royal cities.

In the old quarters the yards must be at least equal to a third of the surface occupied by buildings.

A yard or court must not be less than 40·50 mètres in width.

In these quarters it is permitted, where circumstances require it, and after a special examination, to open areas, which must not be less than 5·75 mètres square. These must be entered from the ground level, must have grated doors, and be paved in asphalte, cement, or some similar material, from which water can easily flow away.

No building may exceed 20·25 mètres in height.

In new quarters the height of the houses must be regulated by the width of the streets, according to the rules given in the general regulations.

In the old quarters, if the width of the street does not exceed 10 mètres, a height of 13 mètres is allowed; when the width is from 10 to 13·50, the houses may be 16·75 metres high, where the width is greater 20·25 metres.

Houses of the first-class must not have more than three storeys, houses of the second class four storeys, and those of the third five storeys.

Within the enclosure of a building site buildings must not be more than one-fourth wider than the yard or court.

When the roof of a building slopes on two sides, its height must not exceed two-fifths of the width of the building; or for roofs having only one slope not more than five-sevenths of the width of the building. The spouts must open freely at a distance of 12 centimètres above the street gutter.

No house must be plastered until six months after the completion of the masonry.

In 1888, the Commission of Hygiene requested that a revision of the regulations might be made as follows:—

Walls must not be built in the period included between December and March.

A house must not be plastered inside and outside at the same time; when dwelling-houses are finished thay must be inspected not only by the Building Commission, but also by a member of the Commission of Hygiene.

The shafts of kitchen chimneys must be at least 30 by 56 centimètres wide, those of other apartments must be 12 by 12 centimètres interior measurement.

Each fireplace must have its own chimney.

The other classes of sanitary regulations are given under their respective heads.

Sanitary Arrangements relating to Air. — As Stockholm is situated in a very open space, the natural condition of the air is more favourable to health than in most other cities.

The old quarters are closely built, as in all old towns, but this defect is compensated by refreshing sea breezes, which purify the air.

There are large public gardens in the modern quarters; the King's Garden; the park of Berzélius, the Humlegården, the hop garden, and nearer to the east the magnificent Djurgården, surrounded by the sea on all sides.

To the north of the Humlegården extends a suburb of houses with gardens named Villastaden, the country town.

That the importance of pure air is more highly appreciated than in many other countries is shown by several regulations. Where the regulations are incomplete, the Commission of Hygiene watches carefully against everything likely to injure the public health, and occupies itself energetically in calling the attention of the authorities to everything opposed to the rules of hygiene.

It must be admitted to the praise of the administration that these demands are not opposed through interested motives, but receive prompt consideration.

Latterly, the Building Commission itself has applied to the Bureau of Hygiene for decisions concerning buildings of a doubtful character from the sanitary standpoint.

According to the terms of the Hygienic Code, the Health Commission forbids the erection of insalubrious houses.

A clause of the same law requires that all public places, hotels, restaurants, etc., should be well ventilated; the Building Commission sends everything relating to this subject to the Bureau of Hygiene before the plans for building have been approved.

Ventilation is superintended by the sanitary police.

In schools and hospitals the system of heated air is most in use, either by central heating or steam, but in temporary erections for the sick a more simple method of ventilating is employed, which will be described farther on.

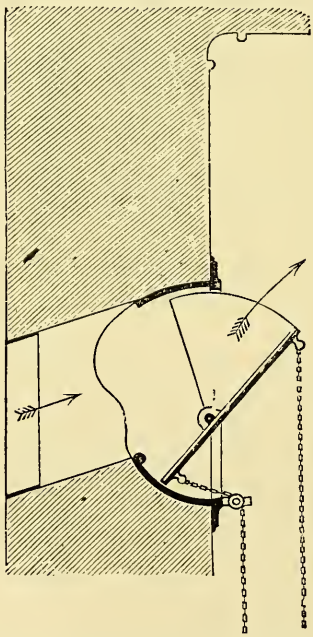


FIG. 161.—WIMAN'S MURAL VENTILATOR.

The sanitary engineer, Wiman, has rendered great services to the system of direct ventilation. He introduces fresh air by means of apertures in the wall (on nearly the same plan as those of Sheringham) and by chimneys and stoves inserted by himself, which expel the impure air at the same time.

Fig. 161 shows a mural ventilator patented by Wiman. The valve is

made of double sheet iron, with a sheet of pasteboard between to hinder the condensation of the steam at the surface; it is regulated by means of two cords, one, which hangs freely, being attached to a small hole pierced in the upper edge, while the other, fixed to the lower edge, passes through a pulley.

The valve, like Sheringham's, has lateral wings, which serve to direct the current of air towards the top without permitting it to escape at the sides.

FIG. 162. WIMAN'S VENTILATING STOVE.

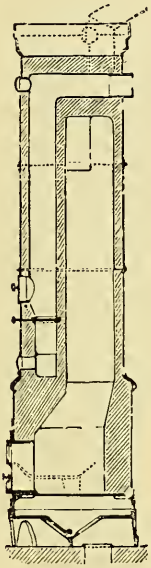


FIG. 163. SECTION OF STOVE IN FIG. 162.

FIG. 164. ANOTHER VENTILATING STOVE BY WIMAN.

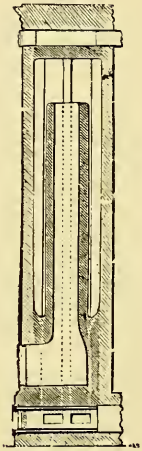


FIG. 165. SECTION OF WIMAN'S STOVE IN FIG. 164.

The four figures, 162–165, show two different forms of Wiman's ventilating hot-air stoves. An original feature in their construction is the isolated chimney placed in the centre of the stove (Figs. 163 and 165), into which the burning gas passes on leaving the fireplace, and descends between the chimney and the side walls to the discharge-pipe, which begins under the fireplace near the key of the stove.

These apparatus are made of fire-proof bricks, covered with sheet-iron, cast-iron, or pottery.

The impure air is withdrawn by pipes placed above, below, or in the middle of the stove (Figs. 163 and 165). In the last, the key is placed immediately below the ventilator, the opening made under the key serving as an outlet for the soot.

These stoves are arranged in such a way as to introduce warm air. The fresh air enters at the bottom of the stove, is heated in the space

between the iron and the fireplace, and goes out again by grated openings on two sides of the stove a little above the fire.

Wiman is also the inventor of an original chimney-pot, the construction of which is shown in figure 166. It is composed of rings joined together like truncated cones, and made of cast-iron, which renders them more durable.

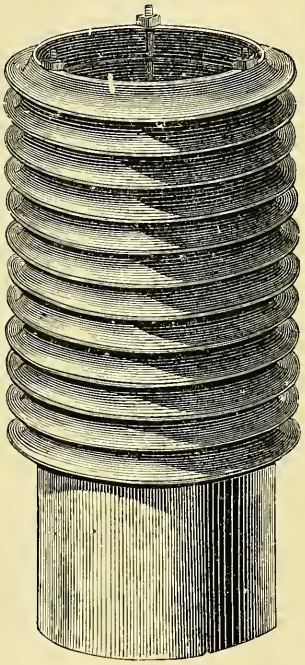


Fig. 166.—Wiman's Chimney-Pot.

Sanitary Arrangements relating to Water.—In Sweden all towns, the population of which exceeds 10,000, have a water service.

The water service of Stockholm was completed in 1861.

At first the city obtained its water from a gulf of the lake Mælar Arstaviken; at present it is supplied in the proportion of 60 per cent. in summer and 90 per cent. in winter by seven large wells dug in the ground of the water-works, the water which filters into them coming from the Arstaviken, or the lake of Hammarby, situated on the other side of a narrow chain of sandy hills.

Two advantages are obtained by digging these wells: the water, making a passage for itself through thick beds of earth, arrives at the reservoirs purer than that of the lake, and its temperature in winter is from two to three degrees higher than that of the lake, which varies from 0·5 to 1·5° C. an important difference, since it prevents the water from freezing during the severe winters of the north of Europe.

In summer, on the contrary, the water in the reservoirs is a little cooler than the lake water.

The wells are covered, and of unequal depth, varying from 4·40 mètres to 1 mètre. At the bottom the walls are made of cylinders of cast-iron, 1·70 mètres in diameter; above they are in masonry, for which granite is substituted near the ground.

Besides the natural filtration, the water undergoes further purification in passing through the artificial filters of sand, which have a thickness from 0·90 mètre to 1·20 mètres, according to the quantity of impure sand which has been taken from the upper bed.

When this is full of sand and organic substances, so that the water can no longer filter through it, one or two centimètres are removed from the surface.

In the months of December, January, February, and March, this operation can seldom be performed, because of the frost. During the remainder of the year it is performed twice or four times in a month.

When the filtering bed has diminished by 30 centimètres, an equal quantity of pure sand is added. The sand which has been removed may be used again after having been thoroughly washed with water in wooden boxes provided for this purpose.

The water of the works near Arstaviken is brought by pumps into two water towers placed at a considerable height, and containing 11,776 cubic mètres, whence it is distributed to the city by simple gravitation. The inside walls and arches of the reservoirs are made of brick, the outside is granite.

The water is distributed by a free stop-cock, in consideration of a fixed payment by the landlords at the rate of about 2·75 francs for each room.

Only industrial establishments pay by means of a meter. In the poor and distant quarters a number of public water-posts have been re-erected.

A chemist is attached to the water service who periodically makes analyses of the Arstaviken water, also the water in the wells, and the filtered water. Besides this, the water in the pipes is analysed at the laboratory of the Bureau of Hygiene.

Leaden pipes must not be used for the distribution of water; all the pipes must be made of iron, or lead lined with tin.

The consumption of water increases every year, and in 1888 it amounted to 87 litres for each person per day. Two-thirds of this quantity were used for household purposes, the remainder for trades and public requirements.

Foods.—According to the regulations of the hygienic code, the superintendence of provisions is exercised by the Health Commission, and the necessary analyses are made in the laboratory of the Bureau of Hygiene.

There are two bureaux of meat inspection, under the control of two veterinary surgeons. Inspection is not compulsory, except for pork, with a view to the discovery of trichinosis, but beef may be taken to the

Bureau for examination by the sanitary police or by buyers. The sellers also find it to their advantage to submit their meat to inspection, in order to obtain a better price.

When the existence of trichinosis in pork is ascertained, the meat is confiscated and destroyed, a fixed payment being given.

The veterinary surgeon of the Commission is also entrusted with the supervision of the sale of provisions which are perishable, such as fish, game, sausage-meat, eggs, etc. Milk does not enter into this class, as there are special regulations for its sale.

Milk Trade.—Since 1886, the trade in milk has been organized according to the following regulations :

The sale of milk in Stockholm and the territory belonging to the city can only take place in

(1) Dairies where one room is specially set apart for that purpose ;

(2) Shops and private stores exclusively devoted to the trade ;

(3) Places in public markets, and streets, on the prescribed conditions.

These regulations do not prevent the owners of dairies and milk-shops from sending milk to the dwellings of their customers.

In order to obtain permission to open a milk-shop, a written statement must be addressed to the Bureau of Hygiene.

All places used for the sale or preservation of milk must be in a sanitary condition, light, well ventilated, conveniently arranged, and kept very clean ; they must not be used until approved by the Health Commission ; they must in no case be used as sleeping-rooms or kitchens, nor must anything be put in them which could infect the milk, or give it a bad taste.

Vessels for the preservation and transport of milk must be clean and in good repair.

All milk-shops must have an inscription in the front, indicating the trade and the name of the salesman ; within, a copy of the regulations must be fastened to the wall.

If a case of disease, whether happening in a house near to the dairy, or in a room connected with the place of sale, the Bureau of Hygiene must be informed without delay ; if the disease is of an infectious character, the Bureau will take the necessary measures for preventing the propagation of disease by the milk.

Until these arrangements have been made, any sale of milk from the dairies, shops, or depôts is forbidden.

If the disease is not discovered until after the milk has been sent to the place of sale, it must not be sent out from that place without authorization from the Bureau. This will give the necessary directions, to which all sellers must strictly conform.

Milk and cream must not be kept or put on sale unless they are free from all mixture of water and all adulteration.

The sanitary police have free access to all cow-houses, dairies, and

milk-shops, with their out-houses, and may take samples, on payment of the price.

Any infraction of one of the above-mentioned regulations is punishable with a fine from 2·80 to 140 francs, unless the offence comes under the communal law.

The offence will also be made public if necessary, and the delinquent ordered to take the measures directed by the Bureau for removing or destroying the condemned milk at his own expense.

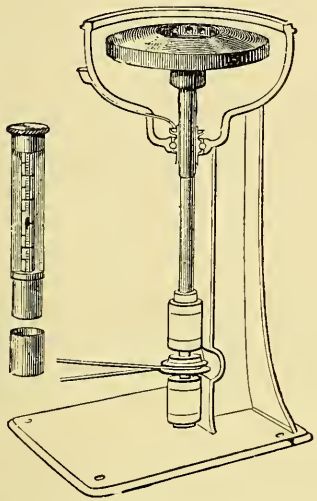


Fig. 167.—De Laval's Laktokrit.

The samples taken by the police are inspected at the Bureau under the direction of the sanitary inspector.

In order to ascertain the quantity of fat contained in the milk, an ingenious apparatus is used, called a Laktokrit, constructed by the engineer, De Laval, and shown Fig. 167.

The apparatus is composed of gauge-tubes of platinum, to which are connected a graduated glass tube, and a cap (to the left of the figure); and of a plate represented in a horizontal position furnished with holes for the gauge-tube. This plate is fitted to the axis of an ordinary De Laval separator, and can be made to revolve at the same speed with it (6,000 to 7,000 revolutions a minute).

When the analysis is to be made, 10 cubic centimètres of milk are mixed in a glass belonging to the apparatus, with an equal quantity of a compound of concentrated acetic acid, and 5 per cent. of concentrated sulphuric acid, which dissolves the casein. The glass is then closed with a stopper, through which passes a glass tube, and kept in a bath of boiling water for 7 or 8 minutes. When the mixture is heated, it is well stirred, and then poured into the cup. The gauge-tube is filled by

plunging the lower part into the contents of the cup, and it is then fixed on the plate.

The upper end of the gauge-tube is pierced with a small hole, by which the overflow of the liquid can escape.

Twelve tests can be made in this apparatus at the same time; if the number is less, the gauge-tubes must be arranged on the plate, so as to be opposite to each other. The motor is set going at the ordinary speed, and rotates for about 3 minutes, when the result of the operation may be read on the gauge-tube, each degree in which corresponds to 0·1 per cent. of fat.

It is found that this method gives results as accurate as chemical analysis.

The separator used in dairies for creaming the milk, to which the Laktokrit may be adapted, has also a hygienic value, as it arrests any contaminating foreign substances in unskimmed milk. Tuberculous bacilli and other bacteria have been found among the impurities deposited, proving that the centrifugal motion has also the effect of purifying the milk.

Milk treated in this way is much less rich in fat than when skimmed in the usual manner.

Sanitary Arrangements relating to the Ground.—Cleansing.—The streets are generally paved, mostly with cut stone; where the slope is more than 1·20 mètres, macadam is employed, as less slippery for the horses; the markets and stands for public carriages are asphalted or cemented.

The cleansing of the streets and removal of refuse from the houses are under the care of the Commission for public roads and streets. All the refuse is taken by railroad to the estate of Riddersvik, which belongs to the city, and is situated about 12 kilomètres from the shore of the lake Målaren, where it is sold as manure.

There are three stations for the Commission, and several loaded trains run to Riddersvik every day.

Sediment is collected into watertight tubs, which are taken away every day, and liquids flow directly to the sewers by pipes from the houses.

Drainage.—Drainage begun in 1866 is organized on the English plan for drawing off rain-water, household water, and subterranean water from the low-lying quarters. The openings for the flow of rain-water are placed at regular intervals by the side of the foot-ways, and provided with receptacles for the deposit of solid matters, which are trapped from the sewer. The waste water from houses should also discharge over traps in the yards.

The large sewers in masonry have a diameter of from 1·20 to 1·80 mètres, and are made of granite slabs, cemented together. They are either oval or circular in section. The smaller sewers are oval, with a diameter of from 0·60 to 0·90 mètre, and are also made of granite. A small portion, about 660 mètres long is rectangular, and constructed of mill-stone.

The smaller pipes, from 0·15 to 0·45 centimètre, are of glazed earthenware.

Ventilation of the sewers is effected by openings placed at the street level, arranged so as to work regularly without flushing. In the lower part of the city, however, it is impossible to avoid deposits, especially at the openings into streams in the suburbs, about 0·90 centimètre below the surface.

For the flow of subterranean water, pits have been dug beside the sewers which are filled with pebbles and gravel. In places where it is necessary, and the sewer is at a sufficient depth, the subterranean water is brought by pipes laid *ad hoc*. In this case care must be taken to prevent contamination with sewage.

Privies.—The system of movable tanks is employed in Stockholm, in conformity with the regulations of the code of hygiene ; but the Commission has the right to authorize the construction of water-closets in houses so situated that the night-soil can be discharged by special pipes leading to the sea.

It has not been possible to give any great extension to the English system, the city engineer having expressed the fear that the excreta might adhere to the granite sides of the sewers, because of the roughness of the granite. As, however, these substances are dissolved by flushing, this fear seems to be ill-founded, as the chief doctor of the Bureau of Hygiene stated in 1883.

At Stockholm, as in Paris, water-closets are still regarded with suspicion. In imitation of the latter city, the closets at Stockholm are provided with filtering tubs, three in number, with filters of different sizes.

According to the calculation of the chief doctor, five-sixths of the excrementitious matters are, however, carried into the sewers without detriment to health. The proof of this is in the comparative rate of mortality in different quarters, where varying arrangements for drainage are in force. The mortality increases nearly in the same proportion as the number of houses without drainage.

The iron tubs used in the system of movable tanks, are lined with asphalt and hermetically closed, so that they can be removed during the day.

They hold 43 litres. The night-soil Service takes them away in covered vehicles at regular intervals, and they are sent by railroad to Riddersvik.

These tubs are placed in each storey, and receive the dejecta directly without a discharge-pipe.

The construction of privies conforms to the regulations of the code of hygiene.

Public urinals are built in several parts of the city ; some of them consist of a kind of wooden chest filled with peat, into which the urine falls, and is transformed into manure by a company. Where there is no water, this system is not objectionable, providing the ground near the chest is made impervious to moisture.

Stables.—The regulations of the Health Commission with respect to stables and cattle-sheds are as follows :—

1. Stables must be built at a distance of at least 6 mètres from a street or other public place, such as squares, fountains, wells, or other places for the supply of water.

2. The erection of a stable near to a dwelling-house is forbidden ; sleeping-rooms must not be built over a stable or near it unless special arrangements are made which effectually prevent the vitiated air from entering by the ceiling or the walls.

3. The ground of the yard must be made impervious to liquid manure.

4. The longitudinal front must run, if possible, from north to south, and the entrance must be on the side least exposed to the wind.

5. The floor must be raised above the ground ; it must be covered with cement or asphalte and have a slope sufficient to cause the water to flow into the sewer and not spread over streets, yards, or public places.

6. The height of the interior must be at least 3 mètres; the ceiling should be impervious to emanations from the stable, lest they should penetrate into the forage loft. For the same reason the openings through which hay is let down must be furnished with tight-fitting doors, as well as the staircase leading to the loft, if there is one.

7. The forage lofts must be provided with dormer windows for ventilation.

8. 21 cubic mètres must be allowed for each animal in the stable.

9. The stalls must be about 3 mètres in length by 1·80 mètres in width. The floor must be slightly sloped along two-thirds of its length.

10. The passage separating two ranges of stalls must be from 1·80 mètres to 3 mètres in width, the rack must be 90 centimètres, and the trench for urine 30 centimètres wide.

11. The windows must be large enough to give each animal half a square mètre of lighted surface.

12. Ventilation must be calculated so as to give 20 cubic mètres for each animal per hour, the windows being provided with hinges that they may be opened in summer.

13. There must be an abundant supply of good water for drinking and washing. If possible, the liquid refuse should be made to flow into the sewers by a subterranean drain.

14. The manure should be collected in a movable watertight box placed above the ground at least 6 mètres from any street, public place, or water supply of any kind. This box must be emptied at fixed times, determined by the Health Commission, the manure being taken away in trucks according to the police regulation in force in the royal cities.

Abattoirs.—From the year 1622 until about 1850 there have been public abattoirs in Stockholm built by the Commune, the use of which was made compulsory, the inspection of meat and animals for the butchers being also enforced.

In 1850 the old abattoirs were destroyed, and butchers were authorized

to slaughter in their own premises. This provisional state of things still exists.

In 1877 a committee was appointed by the Prefecture to examine the question, and a plan was drawn up with a view to building a new abattoir with a cattle market, stables, scalding-houses, etc., according to the requirements of our times, the cost being calculated at £125,000.

Persons who wish to open and carry on a private slaughter-house must obtain permission from the Health Commission, who will give the necessary directions in order that these establishments may be maintained in a state of cleanliness and good order.

Preventive Measures against Infectious Diseases.—Vaccination.—Vaccination may only be performed by doctors. In 1884 an establishment for the supply of animal vaccine was opened by the Health Commission. It is under the direction of the veterinary surgeon of the Commission. The vaccine is not used until the calf has been killed and found to be healthy.

Isolation and Treatment of the Sick.—The plan presented in 1884, by the chief doctor, Dr. Linroth, for the purpose of organizing the treatment of infectious diseases in Stockholm includes,—

1. An hospital placed at one end of the city organized according to the system of pavilions, and comprising :—

   A building for small pox with . . . 20 beds.
   „ „ typhus „ . . . 20 „
   „ „ scarlet fever „ . . . 35 „
   „ „ diphtheria „ . . . 28 „
   „ „ measles „ . . . 35 beds.
   „ with at least ten small observation rooms, each having one bed.
   „ for the staff, containing also rooms for the doctors of the establishment.

   Buildings for offices such as kitchen, laundry, place for disinfection and the burning of straw, stables, coach-houses, ice-houses, etc.

   A place should be reserved on the same ground for two temporary hospitals, the plans and drawings for which must be quite ready so that they can be erected without delay in case of need.

2. A branch establishment at the other end of the city, organized after the same system, and comprising :—

   A building for scarlet fever with . . . 30 beds.
   „ „ measles with . . . . 25 „
   „ „ the staff, and two rooms for special cases.
   „ „ the offices of the establishment.

3. An establishment situated in the group of islands on this side of Vaxholm, intended to receive infectious patients who have arrived by sea, and comprising :—

   A pavilion with 15 beds.
   A place for disinfection.

A building for the staff and officers.

4. A place for disinfection within the city for the healthy members of families exposed to infection, and for suspected clothing.

The number of beds available should be 148 in the large hospital, 57 in the branch establishment, and 15 in the island hospital, in all 220 beds.

Dr. Linroth is of opinion that typhoid fever may safely be treated in the other hospitals of the city as in previous years.

The construction of a new isolation hospital on the above plan was only begun in 1890. The hospital comprises 5 pavilions, comprising altogether 162 beds, a building with 8 observation-rooms, a building for the administration and for the doctor, one for cooking, a laundry, mortuary, etc.

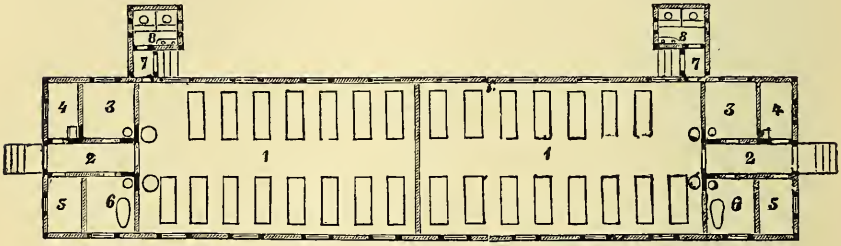


FIG. 168.

1. Wards for patients. 2. Vestibules. 3. Rooms for nurses. 4. Kitchen. 5. Linen-room. 6. Bath-rooms. 7. Passages. 8. Privies. Scale of 1/760.

Before this time the old hospitals were utilized, temporary buildings being erected for special requirements on the model of Fig. 168.

There are constructed of double boards. The interstices of the walls floor, and ceiling are filled up with charcoal.

A barrack on this model was erected in ten days in the park of Bellevue near Brunsviken, when an epidemic of smallpox was threatened. The expense amounted to about £700.

A permanent erection (see Fig. 169) has been constructed on the ground of the hospital Saint Maria to serve as a place for isolation. Its total length is 32·30 mètres, and the width 7·50 mètres. Its height is 15·50 mètres between the ground and the ridge. The front, which looks towards the west, is flanked by a fore-court 8 mètres in length by 5·5 mètres in width. The sides are made of boards $7\frac{1}{2}$ centimètres thick, wainscoted and lined with mill-board outside and inside. The roof is of mill-board covered with asphalte.

The building contains two wards, with 13 beds in each. The space between the wards is occupied by a room for the nurse, a linen-room, and a small kitchen for making drinks. Behind the vestibule adjoining the wards, which can be divided into two parts, is a fore-court in which are

placed the latrines, and the bath-room. The floors of the wards are made of asphalte laid on a bed of cement, which is placed on the ground, covered with a bed of broken stones and gravel. The other rooms have also asphalte floors excepting the nurses' room.

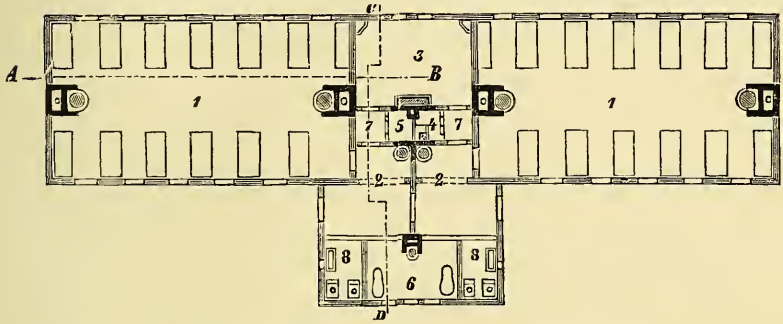


FIG. 169.—PERMANENT BUILDING FOR ISOLATION.

1. Wards for patients. 2. Vestibule. 3. Room for nurse. 4. Dispensary. 5. Linen-rooms. 6. Bath-room. 7. Passage. 8. Privies.

The walls and ceilings are painted in oil throughout the building, in order that they may be easily cleaned. Each bed in the wards has 7·20 square mètres of floor-space and 30 cubic mètres of cubic space. The windows are made in the side wall of the ward, and look east and west, there being 11 in each ward. The windows are two mètres in height by 1 in breadth, their total surface being about one-fourth that of the floor.

The establishment possesses a gas and water service. There are two baths made of copper in the bath-room. The latrines are arranged on the system of movable tanks used in the city, but in such a way that the urine flows away separately by a subterranean pipe. In the closets there are also cisterns in zinc for the soiled linen, a current of water continuously passing through them from top to bottom, and discharging into the sewer. The speed of the current is regulated at pleasure.

In this way all risk from the handling of dry linen worn by the infectious patients is avoided. The linen is not taken from the water and wrung until the moment when it is to be sent to the wash. The cisterns have lids locked with a key.

Heating and ventilation are effected by means of a kind of stove with an iron casing lined with fire-proof bricks. The casing does not come higher than the middle of the stove, and is 6 centimètres from it. The total height of the apparatus is 3·60 mètres, the exterior diameter 0·60 mètre; the heated surface 7 square mètres.

The fresh air, entering by a pipe 60 centimètres by 30, arrives at the bottom of the stove and is heated in passing between the stove and the casing; the ventilating-pipe is provided with a sliding valve.

The stoves are arranged for slow combustion, fed at long intervals during the day, and kept locked.

The impure air escapes by pipes heated in the chimney, each discharge-pipe having an opening near the floor for ventilation in winter, and one under the ceiling for summer; the valves of these openings are enclosed that they may be out of reach of the patients.

The upper sash of two opposite windows in each ward is provided with hinges below, so as to open within, and has an iron plate on each side.

All the air-pipes are arranged so as to be easily cleaned.

During the summer more thorough ventilation may be secured by a water ventilator on Trentler and Schwartz's systems, fixed in the roof above the centre of the building. This ventilator is put into communication with the wards and the outer air in such a way that air may be admitted or excluded at pleasure by opening or shutting valves.

The cost of this barrack is about £1,440.

The city keeps a special carriage resembling the one used at Brussels for the removal of infectious patients. It is lined inside with varnished wood, which can be easily cleaned after each journey.

Disinfection.—There is an establishment for disinfection in the city, composed of 4 chambers, with a bath-room, stove, and room for the inspector, who takes charge of the stove, which is constructed by Reck, of Copenhagen.

Persons who have lived with patients suffering from infectious diseases remain in the establishment while their dwelling is disinfected, and there undergo a complete purification with their clothing.

Special vehicles are set apart for the transport of infected clothing. Rooms are disinfected by sulphurous fumigations, after which they are cleaned and ventilated.

Mortuaries.—Every parish possesses a mortuary vault. According to the regulations of the Health Commission, bodies must not remain there more than forty-eight hours in the hot season, and seventy-two hours in cold weather.

Everything relating to burials and cemeteries must conform to the regulations of the Hygienic Code.

Prostitution (*Öfverståthallåreembetets föreskrifter of the 2nd June*, 1875).—A bureau of inspection has been instituted for the supervision and inspection of public women under the superintendence of the Health Commission and the supreme direction of the chief doctor of the city. This bureau includes a medical and a police department. A sufficient number of doctors, appointed by the Commission at the nomination of the chief doctor, are attached to the first. The second belongs to the Prefecture, and is composed of a director, a police officer, and a certain number of agents.

Every woman who leads a notoriously dissolute life is considered a prostitute.

All prostitutes must attend at the bureau twice a week, or oftener if it is

considered necessary, at the hours and days fixed, for the purpose of a sanitary examination. If a prostitute neglects to present herself, the Prefecture compels her attendance.

The women subject to inspection are registered in a special pass-book, in which are written the family name, Christian name, any name by which she is known, the description of her person, her age, place of birth, relations, former employment, and other circumstances relating to her manner of life, as well as the motives which have driven her to prostitution.

It must also be mentioned if she has suffered from venereal disease, and where she has been treated.

Every registered woman must leave her certificate at the bureau.

These visits are without payment, but a more private inspection is allowed on payment of about 1·40 francs each time. The money from these payments is collected by the head of the police department, and is applied towards the cost of maintaining the bureau.

The order also includes disciplinary and penal regulations for registered women, as well as instructions for the officers of the bureau.

A woman who has been subject to inspection may be exempted if she announces her intention to return to an honest life. In this case she must remain for three months under the supervision of the police; but if her conduct gives rise to no unfavourable remark, she may be erased from the register at the end of that time.

The same may be done when parents or guardians undertake charge of her, but in that case permission must be obtained of the Prefecture.

The doctor must at once send to the hospital any woman who has a sore of any kind or any morbid secretion of the genital organs, without judging whether the disease is contagious or not.

When the director is informed that a registered woman has still a father, mother, or other near relations living, he must inform them in writing of the kind of life she is leading.

He must also endeavour to discover procurers and houses of ill-fame, as well as quacks and persons who lodge women suffering from venereal disease.

Public Buildings.—The city of Stockholm possesses several civil hospitals and several schools built according to the rules of hygiene.

Among the first that of Saint Göran in the Kungsholm is incontestably entitled to the first rank; but the hospital of Sabbatsberg, composed of several one-storey pavilions in wood, the new orphanage to the north of the city, and the hospital Sainte Marie to the south, rebuilt in 1886, also satisfy the required conditions, although they do not completely correspond to the English type.

These hospitals are warmed by the central system for heating, which is applied by preference to other public establishments. A detailed description of these ingenious constructions has already been given.

Workmen's Houses.—In Sweden, as elsewhere, good regulations for the building of houses for workmen have not yet been established. The

plans are not examined by the Health Commission, but only by a Commission for buildings, which takes no special foresight of sanitary arrangements. This applies even to recent erections. They are for the most part vast barracks with a common corridor for several families. It is therefore difficult to prevent the spread of infectious diseases in them.

Some manufacturing companies, however, being anxious to keep their good workmen as long as possible, have erected more suitable dwellings.

The most remarkable of these are on the Kungsholm, and are occupied by the workmen of Ekman's carpentry establishment. These dwellings, 18 in number, are in the form of a parallelogram. The houses have a wooden framework, they have two storeys, and each contains two sets of apartments, including a bed-room, kitchen, ante-room, wood-house and closet.

Each block has a separate entrance. The rooms measure from 3·60 mètres to 4 60 mètres square, and 2·70 mètres in height. The privies, arranged on the movable tank system in force, are in a small isolated building of an octagonal form, which is divided into eight closets, with a common discharge-pipe in the centre.

The houses are separated by small gardens, the rent varying from £11 to £12 a year.

Hygiene of Factories.—The Swedish sanitary administration has entrusted the supervision of hygiene in factories to the Health Commission. The regulations concerning it are found in the Hygienic Code, as well as the decrees relating to the employment of minors in factories, trades, or other industries, for which special inspectors (*Fabrikinspectörer*) are appointed.

Hygiene of Schools.—The Hygienic Code directs the Health Commission to inspect schools, and especially to see that they are well ventilated. The conditions imposed by this Commission at Stockholm are as follows :—[1]

1. The dimensions of the schoolrooms must be such as to allow each scholar 5 or 6 cubic mètres of respirable air, and about 1·50 mètre of floor space.

2. During lessons and exercises a certain quantity of pure air, about 15 to 25 cubic mètres per hour for each pupil, must be introduced into the schoolrooms. This amount must be increased in proportion to the age of the scholars. An equal quantity of impure air must be expelled from the room. In rooms for recreation, gymnastics, etc., the air must be renewed two or three times in the hour. The air must be completely renewed in the schoolrooms during the time for recreation.

3. In dressing-rooms the air should be changed twice in the hour. They should be thoroughly ventilated.

4. The temperature of the schoolrooms taken 1 mètre above the floor

[1] According to the plan of Dr. Almgrist and the engineer Westin.

should be maintained at about 17° C. during school-hours; the dressing-rooms and halls for gymnastics about 14°. The temperature should be as nearly as possible uniform in every part of the room.

5. The pure air introduced by the ventilating-pipes should not have a temperature lower than + 12° or higher than + 40°.

6. The central heating apparatus must not be heated beyond 40°, except at those times of the year when the outside temperature is down to − 20°.

7. The temperature of the heating-surface placed in the schoolrooms must not exceed 90°, unless they are provided with a screen, or so disposed that the radiation does not occasion any inconvenience.

8. No clothing or other articles which could vitiate the air must be kept in schoolrooms.

9. All heated surfaces must be hermetically closed, and be easily accessible for cleaning and inspection.

The heating apparatus placed in schoolrooms should be simply ornamented, and the surfaces should be plain, crevices for harbouring dust being carefully avoided.

10. Openings made in the outside wall for the admission of fresh air must not be placed near gutters, latrines, urinals, or any places from which the air might be infected.

11. Pipes for fresh air and vitiated air must not be laid in damp ground, nor traverse substances, which, though dry, might have an unfavourable effect on the air.

12. The openings for ventilation should be managed so that no draught is felt by persons in the room. Some of the openings by which air is expelled in winter must be made near the floor; for ventilation in summer they should be near the ceiling. The openings near the floor must be so high that dirt, etc., cannot fall into the pipes when the room is swept.

13. All pipes for ventilation, whether inside or outside, must have openings which will permit of their being thoroughly cleaned.

14. The mouths of ventilating-pipes in the schoolrooms, as well as outside, must have a grating which will prevent large particles from entering them. These gratings must be so fixed as to allow of their easy removal for cleansing.

15. The size of the pipes for ventilation should be such as to give the current of air a velocity of about 90 centimètres.

16. Fresh air in the schoolrooms must have 50 to 60 per cent. of humidity, and a temperature of 17°.

17. When the system of central heating and ventilation is used, the rooms for the heating apparatus must be spacious, and the doors high enough to permit the entrance of an adult in the upright position. The walls of these rooms must be whitewashed, and kept in good repair, the maintenance of the proper temperature in the schoolrooms being checked by thermometers.

The openings for fresh air must be so managed that the amount entering over the hot plates does not depend on the direction of the wind.

18. The products of the combustion of the gas used for lighting must be carried off. The discharge-pipes may be opened and shut by the same taps which are used for the gas.

19. The upper sashes of the windows in the schoolrooms and dressing-rooms should be furnished with hinges and side-plates, that they may be opened from within. The inside windows must also have hinges.

20. There must be free ventilation in the privies, and round the vessels which receive the dejecta. Two different systems are employed for this purpose, one for ventilating the closet, and the other for ventilation under the seat. The discharge-pipes must be carried above the level of the roofs of the neighbouring houses.

21. The urinals must always be connected with subterranean drainage, and have a supply of water for flushing.

22. Cellars, outhouses, etc., must have openings for the admission of fresh air, and drainage-pipes.

23. All ante-chambers, staircases, garrets, etc., must be kept clean, and no accumulation of dirt or dust permitted.

24. During the hot season, the measures indicated above do not suffice for thorough ventilation, and the rooms must be aired night and day by means of ventilators placed in the windows.

25. The surface of the windows must be at least equal to one-sixth of that of the floors.

26. There must be a sufficient number of play-rooms and recreation grounds.

The floors must be varnished by coats of oil.

27. Rooms in which the ventilation is well organized should have the walls and ceilings painted in oil.

With reference to the superintendence of school hygiene, the regulations for schools in Sweden, issued in 1878, enact that where educational establishments possess the means, they should appoint a doctor to care for the poorer scholars, and to investigate any circumstances likely to have an unfavourable influence on the health of the children.

The doctor must examine the pupils at the beginning and near the end of each term, and note the result, according to a formula given by the Medical Council. When this examination has been made, the doctor decides whether any pupil should be excused the military or gymnastic exercises wholly or in part.

At the end of the term he makes a report concerning the state of health of the pupils of the school.

As these arrangements did not yield the desired results, a Committee was appointed whose duty it is to consider questions relating to school hygiene. The report of this Committee, edited by Professor Key, is the most instructive and complete work which has appeared on this subject. It includes a detailed plan for sanitary inspection in public schools.

This is to be entrusted to private doctors having each a teacher as a colleague for such work as the weighing of scholars, choice of furniture, etc., and the daily supervision of the school hygiene.

The plan does not seem practicable, because school hygiene is kept too much apart from public hygiene. For example, the decision as to the closing of schools in times of epidemics is left to the school authorities, whereas such questions should undoubtedly be decided by the sanitary administration.

Finally, according to this project, it is the duty of the school doctor to examine and approve sites for building, but this business ought to be entrusted to the Bureau of Hygiene, which is occupied exclusively with questions relating to public hygiene of this nature, and must therefore be more competent to decide on them than the school doctors.

FINLAND.

CHAPTER I.

SANITARY LEGISLATION.

General Remarks.—Sanitary Administration.—Provincial Communal and Urban Electors, Hygienic Service of Communes.—**Sanitary Legislation.**—Health Commissions in Towns.—General Regulations for the Health of Towns.—Public Hygiene in Rural Communes.—Provisions.—Epidemics and Cemeteries and Burials.—General Arrangements.—Regulations for Quarantine.—Laws for Vaccination.—Regulations for Buildings.—Factory Legislation.

General Remarks.—Sweden and Finland have had a common history from the year 1157, when the Swedes arrived in Finland for the purpose of introducing Christianity, until 1809, when the country was united with Russia in consequence of the Napoleonic revolution.

The Swedish religion, customs, and manners have been transmitted to the Finn race, and the two populations have worked together in the establishment of legislation.

As their civilization was Scandinavian in origin, the Finns in many respects bear a great resemblance to the Swedes, especially in their ideas of morals and way of looking at life.

Besides the Finnish population, which is considered to belong to the Magyar family, Finland is inhabited by a considerable number of Swedes. The total population of the country is about two millions and a half.

After the grand duchy of Finland was united to Russia, it retained its constitutional liberty, its laws, separate administration, and finances. The country is governed by a Senate, in the name of the Czar, who is the Grand Duke.

Public hygiene, so far as it is developed, is based on the ancient laws of the country, and resembles that of Sweden in many points. But its importance is not yet universally recognised in Finland, where the rate of mortality is higher than in Sweden, and reaches an average of a little more than 22 per 1,000.

Lately a more lively interest has been shown in this important social question by the Government as well as the people; and as the country has been in possession of a very good hygienic code since the year 1879, it may be anticipated that when a short time has elapsed, its sanitary organization will not be inferior to that of other civilized States.

For the furtherance of this result it is very important that a Chair of Hygiene should be created at the University, and that in the future medical students should go through a course of instruction on this subject.[1]

[1] This Chair was established in 1890.

Sanitary Administration.—**The Medical Council** (*Förordn. of the 30th October*, 1688; *8th February*, 1816; *7th April*, 1830; *and 21st January*, 1878).—The direction of affairs relating to hygiene and medical science is in the jurisdiction of the head of the civil department of the senate, which represents the supreme authority.

The immediate superintendence and direction is entrusted to a special authority, the Medical Council (*Medicinalstyrelsen*), comprising a general director, who is the president, and three members.

The director must have obtained the degree of doctor in medicine and surgery in the University of the country; two of the members must be Finnish doctors in possession of a legal diploma; and the third must have undergone the examinations for pharmacy without, however, possessing or managing an apothecary's shop.

The official department of the Medical Council includes a secretary, who must be a lawyer, a treasurer, a registrar, a clerk, and several assistants.

Five supplementary doctors and a veterinary surgeon are also attached to the Medical Council, who are instructed to perform any duties imposed by the Council, which consist principally in supplementing private doctors, and assisting them during the prevalence of epidemics.

The functions of the Medical Council are as follows:—

To superintend subordinates and all the staff of the medical service.

To endeavour to prevent illness, and combat everything which might be injurious to health.

To superintend hospitals, asylums for the insane, orphanages, bathing establishments, dispensaries, druggists' shops, and vaccination.

To unify the certificates of the doctor in medico-legal cases.

To give advice whenever consulted by competent authorities. The Council must present to the Senate an annual report on the sanitary condition of the country, mentioning the measures that have been taken against the spread of disease, and in the interest of public hygiene, also any improvements which it considers necessary.

For this purpose the Council must send the reports and bulletins of its subordinates.

The general director makes tours of inspection in the country every year, so arranged that he may go through the whole of it in two years.

Provincial, Communal, and Urban Doctors.—Hygienic Service for Communes.—Provincial doctors (*Provinciallläkare*) are established on the same basis as in Sweden.

When Finland was separated from the mother country these doctors were 11 in number; there are now 53. The instructions they must follow, bearing the date 17th January, 1832, determine their duties as inspectors of the hygienic service in their districts with more precision than in Sweden.

The regulations are as follows:—

Attention to public hygiene is the most important duty of the provincial

doctor in his district; he must therefore apply himself to the discovery of everything likely to endanger health in given places, during different seasons, and in connection with various professions or trades. He must do everything in his power for the removal of nuisances as well as to prevent the progress of endemic or epidemic disease.

The provincial doctor is entrusted with the superintendence of vaccination in his district. He should anticipate the outbreak of infectious diseases, and prevent them from spreading.[1]

The regulations necessary for this purpose, and the arrangements to be made for nursing patients at home, belong to the commune. Police agents and pastors are also bound to assist the doctor in organizing the sanitary service.

All the functions relating to medico-legal cases are discharged by the provincial doctor (except in towns). He must also look after any mineral waters which may be found in his district, and superintend vaccinations, midwives, and other persons forming part of the medical service, also the apothecaries' shops, which he should visit every year.

It is incumbent on him to render an account of the exercise of his duties to the Medical Council, and to present a detailed report every year, the nosographic and demographic statistics of the district being appended, for which the materials are furnished by the communal authorities and the clergy, whose duty it is to register births, marriages, and deaths.

Vaccination has a separate report, accompanied by statistics based on the bulletins sent in by the vaccinators.

The provincial doctor is nominated and paid by the government.

There are communal doctors for private attendance on patients in their dwellings (*Kommunalläkare*). The State pays them in part. They give help to the provincial doctors whenever an epidemic is prevalent or apprehended.

The town doctors (*Stadsläkare*) are appointed and paid by the municipality. Their duties include public hygiene and medico-legal medicine.

In Finland, as in Sweden, the organization and control of public hygiene, as well as the care of the sick, are left to the commune. Each town has its Health Commission (*Helsovårdsnaemnd*). In rural communes these duties are performed by the Communal Council. Each commune must take care of its own poor.

Sanitary Legislation (*Helsovårdsstadgan of the 22nd December*, 1879).

Health Commissions in Towns.—Health Commissions in towns are composed of members *ex-officio*, and members chosen by the Communal Council.

The *ex-officio* members are—

1. The chief municipal doctor.

[1] A new plan relating to the instructions for provincial doctors is now submitted to the Government. It is proposed to extend the powers of provincial doctors in their districts in matters concerning hygiene.

2. The chief of the police.

3. The municipal engineer.

4. The municipal architect.

Three to six members are elected by the Municipal Council.

They are appointed for two years, but may be re-elected.

The president and vice-president are chosen from the members of the Commission, and elected by them.

The result of the election must be communicated to the Prefect, the Mayor, and the Municipal Council.

Experts may be authorized by the Commission to attend the sittings with a deliberative or consultative vote.

The Health Commission for a town must—

1. Take all possible measures for ascertaining the sanitary condition of the town, in its different parts and suburbs, and inquire into all circumstances which might have any influence on sanitation.

2. Enforce obedience to the law and special regulations, and summon before the tribunals any persons who have been guilty of infractions of the above-mentioned regulations.

3. Make any propositions to the administration which may be found necessary for the public health.

4. At the request of the administration, direct measures to be taken concerning factories and other establishments which are, or might become, dangerous to public health, also concerning all questions relating to public hygiene.

5. Examine into all nuisances brought before its notice by the administration or the inhabitants, and cause them to be removed if possible, or inform the administration of the measures which are necessary.

6. Prepare statistics of disease and death.

7. Send annual reports to the Mayor, the Prefect, and the Medical Council.

8. Exercise the right of entry into all yards, workshops, factories, restaurants, workmen's lodgings, furnished apartments, and even private houses, for the purpose of inspection. In the last case the visit can only be made by two members of the Commission, furnished with a written order, which they are bound to present to the owner.

9. Before making any regulations affecting a free person he must receive a written order requiring him to attend before the Commission, from which he will receive the necessary orders.

If the person summoned does not appear, the decision must be made in his absence, and written directions sent to him.

II. *General Regulations respecting the Health of Towns.*—It is forbidden to inhabit or to let apartments which the Health Commission considers unhealthy, deficient in light or ventilation, damp, dirty, etc.

The municipal police must superintend and publish regulations on the cleansing of sewers, yards, privies, receptacles for refuse, according to the instructions given by the Health Commission.

When a town is to be newly built or a quarter improved, the sites intended for building must be completely levelled. In all cases a survey of the town must be executed within ten years from the publication of this law. On this basis a plan for the drainage of the town should be made and executed when necessary.

When the finances and circumstances of a town permit, sewers must be constructed of sufficient size to meet its requirements. When a sewer runs along a street, the owners must make a connection with it by means of branch-pipes leading to their houses or yards, according to the system approved by the Health Commission.

If the branches are defective, the owner is compelled to put them into repair; in case of negligence the Commission will make the repairs at his expense.

Each town must see that there is a plentiful supply of good water for household purposes.

Springs and wells must be covered and constructed in such a way that rain-water and refuse cannot flow into them, and must always be kept in good repair.

If it happens that a spring, or well, whether public or private, contains deleterious matters, or if illness has been caused among the inhabitants by their water supply, the reservoirs must be closed or even destroyed.

The construction of sewers, stables, and cow-houses, and the removal of night-soil must be managed according to the regulations for buildings, and the special hygienic laws which are in force in the town.

Factories for glue, tanneries, manufactories of leather, factories for sugar, and wax matches, drying and burning bones, melting-houses for tallow and soap, factories for chemicals and dyes, varnishes, oil-cloths, matches; manufactories of starch, manure, gas-works, laundries, dye-works, abattoirs, sausage manufactories, must only be built in open spaces, distant from the more populous parts of the town; in all cases the sites must be approved by the authorities.

The same rule must be applied to other establishments and workshops not enumerated above, but which might become nuisances because of refuse, dust, smoke, gases, or bad odours, as well as industrial works likely to cause contamination of water.

These can only be opened in the places and under the conditions directed by the authorities in each special case.

Salted skins, rags, and other things liable to putrefaction must only be kept in places approved by the authorities.

Before a factory or workshop in the above-mentioned classes can be erected, application must be made to the authorities, who are bound to consult the Health Commission.

It is the duty of the Commission to watch over the health of these establishments and to take measures for securing the workmen against dangers to health.

Animals can only be slaughtered in abattoirs or other authorized places.

Bodies of animals must be buried in places reserved for that purpose.

The Health Commission must superintend the laws for the work of children and young people in industrial establishments and workshops, and must see that their rooms are not unwholesome.

For the organization of an effective public hygiene, each town is obliged to make special regulations suitable to the needs of the locality.

These regulations must include :

1. Special directions for the Health Commission.

2. Special regulations for the inspection of lodgings and other furnished houses, the cleansing of sewers, privies, and yards, system of latrines, insalubrious establishments, and other questions relating to the public health.

III. *Organization of Public Hygiene in Rural Communes.*—The right of superintending public health in a canton belongs to the Communal Council.

When hygienic systems are discussed, the provincial doctor and communal doctor, if there is one, are authorized to be present at the discussion and have a consultative vote.

Before the end of February in each year the Council must send a report to the provincial doctor on the general health of the preceding year, and the measures which have been taken for the improvement of the public health.

The Council must examine into everything which might influence the public health and endeavour to make the necessary improvements. It has also the powers of a sanitary police for superintending the law, and has the right to demand the assistance of the administrative police where necessary.

The rural communal councils have the same right of inspection as the Municipal Health Commission.

Especially they must—

See that villages are kept clean ;

Be careful that springs, wells, and streams of water are not contaminated by closets, stables, deposits of refuse, industrial establishments, etc. ;

Must also see that establishments are not built in such a way as to endanger the health of workmen or neighbours, and that schools, asylums, etc., are so built as to be in accordance with the general principles of hygiene.

The commune must make local regulations if requested by the Prefect or required by circumstances, which must be submitted for approval to the Medical Council.

The Communal Council must examine into the causes of the mortality of children and endeavour to remove them. It must also try to lessen the amount of disease and mortality of men and animals by following the regulations issued by the Medical Council or the Prefect ; and in accordance with medical directions, should seek to prevent the occurrence of such disease.

IV. *Foods.*—Foods must only be kept and sold in clean and well ventilated shops.

Any person selling or preparing foods and drinks must not prevent the authorities from inspecting, examining, and analysing them.

It is forbidden to sell the flesh or milk of animals which have succumbed to any disease whatever or died suddenly.

Waters and effervescing drinks, as well as mineral waters, natural and artificial, must be inspected. The maker must send the analysis of his productions to the Health Commission and Medical Council.

Stuffs, carpets, and toys, must receive chemical examination, if there is any suspicion that they are dangerous to health.

Adulterated or unwholesome foods, drinks, etc., are confiscated and destroyed, the sellers and makers being prosecuted.

V. *Epidemics and Epizootics.*—The owner of a house, and the father of a family must immediately inform the Health Commission of any case of infectious disease.

In rural communes, the president of the Communal Council must immediately send information of such cases to the provincial doctor, who will give the necessary regulations for preventing the spread of the disease. The Prefect should be informed of these facts at the same time.

In towns, the Health Commission must employ all possible means for combating the disease without delay. If a serious epidemic is threatened, the Commissions are required to execute all the regulations of the medical Council; they must also employ all other means of prevention known to them; but free transit, whether by land or sea, must not be interfered with except by quarantine permitted by international law.

In times of epidemic the Commissions must—

1. Seek to understand the character of the disease, its origin, progress, and the degree in which it is infectious;

2. Make known by suitable publications the means of avoiding infection, and the treatment to be given before the arrival of the doctor. In case of the spread of the epidemic, they must send weekly reports to the Medical Council concerning the number of persons ill, recovered, or dead;

3. If it appears necessary, the infected place may be divided into districts of smaller size, and inspectors may be appointed for each district;

4. If needed, the Prefect may be asked to appoint additional doctors;

5. The Commissions must make arrangements for the isolation of patients in hospitals. After the cessation of the epidemic, they must send reports to the Prefect and the Medical Council, containing an account of the measures taken, as well as observations on the origin, progress, and character of the disease, accompanied by statistics. These reports are made on printed forms given by the Medical Council.

In case of cattle plagues, Commissions must take the necessary measures and enforce the regulations for the prevention of disease in animals.

During the prevalence of an epidemic, large assemblies should be avoided. The Prefect has also the right, in conjunction with other

authorities, to change the days and places for communal and district meetings, fairs, auctions, quarterings of troops, etc.

Special laws are enforced for the purpose of preventing the importation of foreign diseases.

VI. *Cemeteries and Burials.*—Cemeteries must be at some distance from towns or villages.

A sandy soil should be chosen for cemeteries, and care must be taken that the ground-water may not contaminate springs, wells, or inhabited places in the vicinity.

If necessary, the cemetery must be drained. It should be planted with trees if possible.

Bodies must be buried in graves 1·80 mètres deep before decomposition has advanced so far as to occasion any nuisance. If it is, for any reason, necessary to keep a corpse longer, it must be placed in a mortuary or similar establishment.

The Health Commissions may make special regulations for burials in times of epidemic.

Burial in vaults is forbidden, except in the case of enbalmed corpses.

Repeated burials in the same ground are only allowed after the lapse of twenty years.

The transport of bodies cannot be permitted unless they are placed in metallic coffins hermetically closed, or in the ordinary coffins enclosed in a packing case, which must be coated with tar.

VII. *General Arrangements.*—The Prefect must see that the Communes and Health Commissions perform their duties in relation to the public health.

The Medical Council arranges schedules for the presentation of statistics of disease and deaths throughout the country. Every doctor paid by the State, the communes, companies or proprietors, and every doctor subsisting by private practice, must note all his medical observations in the above-mentioned forms.

In towns the doctors in attendance on the patients give the certificates of death. The certificate is gratuitous, and must be made in writing in a printed form. When the death is to be registered (which must be done by the relatives at the office of the pastor), it is necessary that the doctor's certificate should be brought.

It is the duty of the pastor to send these certificates or bulletins to the Health Commission, with a statement as to the annual movements of the population.

Regulations for Quarantine.—Finland has inherited from Sweden a detailed legislation dating from the 7th of November, 1806, which has served as the basis of later modified regulations. These regulations are: the circulars addressed to Prefects dated 17th February, 1818; those of the 24th February, 1824; 11th December, 1827; 15th May, 1832; an address to the President of the Medical Council, dated 18th August, 1834; the edict of the 2nd of May, 1865; the circular of the 14th November,

1871 ; letters to the Medical Council, of the 12th July, the 13th August, 1884, and the 26th June, 1885.

Laws for Vaccination (*Förordningen of the 17th December*, 1883. *Regulation 15th January*, 1884).—Vaccination has been practised in Finland since 1804, and a grant was then made by the State for the first time.

In 1824, vaccination was placed under the superintendence of the Medical Council, and provincial doctors were directed to superintend its performance. It was not made compulsory until 1885.

The law adopted by the Sovereign and the Chambers, dated the 17th December, 1883, contains the following regulations :—

Vaccination is entrusted to the care of the Communes, under the inspection and control of authorities appointed by the State. For its performance each Commune engages one or more vaccinators, who possess a diploma. Neighbouring Communes may employ the same vaccinator if the Medical Council approves this arrangement.

Before engaging a vaccinator, an assurance of his competence must be obtained from the Council of Hygiene (*Kelsovördsnaemnd*) for the towns, and for the country from the provincial doctor of each district.

Parents and guardians are bound to have children vaccinated before they are two years old, unless there are important reasons for delaying the operation. This obligation applies to all young persons who have not been vaccinated successfully, or not vaccinated in infancy.

In order to verify the success of the operation, the patient must be presented for examination at the time and place appointed.

The vaccinator must not be hindered from collecting vaccine from the persons he has vaccinated, leaving however one pustule intact.

Masters of houses, managers of works and factories, etc., must not prevent their servants, workpeople, and persons connected with them in any way, from submitting to vaccination, nor from attending at the places appointed for the operation and examination.

When parents, guardians, and other responsible persons having children under their care, have neglected to present them for vaccination before they are two years old, or when adult unvaccinated persons have failed in this obligation, the Commission of Hygiene for the country, and the magistrate in towns, must order the operation to be performed within a fixed time, after examination into the reasons alleged to justify the negligence. Disobedience is punishable by a fine of two to fifteen francs. If the operation is still delayed, a new term will be fixed for the offender, and further negligence will be punished by a larger fine, not exceeding thirty francs.

The regulation of the 15th January includes detailed arrangements for compulsory vaccination. Besides these it comprises the following regulations:—

Persons authorised to practise vaccination :

(*a*) Doctors having diplomas.

(*b*) Professional vaccinators.

(*c*) Midwives who have been recognised as competent after examination.

(*d*) Other persons of either sex to whom the director of the depôt for vaccine, or another doctor having a diploma, shall have given a certificate attesting that they possess the ability requisite for the practice of vaccination, that they understand the progress of the vaccine vesicle, that they know how to keep the registers of vaccination, and in general are acquainted with whatever is necessary for the exercise of their profession.

Vaccination may be performed at any season, and carried on without interruption, but it is generally performed in the summer, unless local circumstances make another time preferable.

If smallpox breaks out in any place, all unvaccinated persons must be vaccinated without delay.

No school or educational establishment maintained or assisted by the State may receive pupils who are not provided with a certificate of vaccination.

Governors of prisons, houses of detention or correction, must see that all persons confined in them are vaccinated, if it cannot be ascertained that the operation has already been performed.

Every sailor must prove that he has been duly vaccinated before embarking.

It is the duty of every one who practises or superintends vaccination to increase the confidence of the public in re-vaccination by advice and explanations.

The vaccinator must only use vaccine of good quality, taken from subjects in perfect health, at least five months old, whose parents are not suspected of suffering from any infectious disease.

In each Commune one or more inspectors should be chosen, by preference from the members of the Communal Council, who should superintend vaccination, each in his own district, observe its progress, and certify that the register is properly kept.

The clergy must take care to interest the population in the subject of vaccination, and make the public understand its value.

The pastor of each parish is bound to send yearly to the Communal Council a list of the children born in the course of the preceding year, and of unvaccinated persons. In his parish register he must note the names of those who have been vaccinated.

The duty of preparing instructions for managers of the depôts for vaccine and vaccinators devolves on the Medical Council.

The following articles are among the regulations :—

The vaccine is inserted by means of six incisions made in the outside of the upper part of the arm, at a distance of at least fifteen millimètres from one another.

Vaccine must only be taken from healthy and well-developed vesicles not more than seven days old ; it must be limpid and pure ; if mixed with blood, it must not be used.

It is forbidden to take vaccine from illegitimate children, or children

suffering from any cutaneous eruption, glandular tumour, or other disease, or from any children having redness or soreness in the throat, excoriations of the tongue or corners of the mouth, soreness of the genital organs or the anus, or from any having a swelling or running at the nose.

Vaccination is considered perfectly successful when on the day for inspection the six incisions have resulted in five well-developed vesicles. If there are fewer than these, or the development is imperfect, the operation must be renewed, either immediately or in the following year.

Regulations for Buildings (*Förordningen of the 18th March*, 1856).—When there is a project for building a new town, rebuilding a town which has been burnt, or remodelling existing towns, the ground must be divided into quarters, with large squares and spacious streets. If the nature of the ground and other circumstances permit, the town should be traversed by one or more open spaces or esplanades, at least 36 mètres in width, laid out in a suitable manner, and planted with trees of full foliage. The principal streets should also be planted with trees. If required, suitable sites should be set apart at least 36 mètres from the town for the use of persons who wish to build houses of smaller size than those prescribed for the town.

The streets must be regularly laid out, and not be less than 18 mètres in width. In those parts intended for small houses a width of 12 mètres will suffice for the streets.

In planning the quarters care must be taken that they are laid out as nearly as possible at right angles, and divided into four or six building lots, which must be at least 54 mètres in length by 42 in width, or have an equivalent area. In the quarters intended for small houses the lots may be smaller, but they must not be less than 24 mètres in length by 18 mètres in width, or have an equivalent area.

Each quarter must have a good supply of water easily accessible.

Houses constructed of stone or mortar and timber-work with bricks may be placed side by side, but when the houses are made of wood there must be a space of at least 15 mètres between them, which should be planted with trees. These must be completed three years after the houses at the latest, and the owner must afterwards keep them in good order.

No ground may be divided into portions so small that they cannot conform to the above regulations, and supply for each house built of stone an open yard of at least 190 square mètres, with a separate entrance.

Contractors are responsible for the good execution of the work entrusted to them, which must be inspected by persons appointed by the authorities.

Stone houses may have several storeys, and be in contact with other houses. In all cases a space of 190 square mètres must be reserved for the yard.

Houses made of wood or timber-work with bricks must not in any case have more than one storey, and the height must be 6 mètres to the cornice of the parapet.

Outhouses in wood or timber-work must not exceed 4·20 mètres in height from the basement to the roof.

There must be a space of not less than 6 mètres between houses made of wood or timber-work. If the next house is of stone, a space of 3 mètres is sufficient.

The building of houses with a lower storey of stone and an upper one of wood is not permitted, even though the lower rooms are vaulted and the walls of the upper storey made in mortar, glazed earthenware, or even lined with bricks.

Legislation for Factories. — Besides the regulations relating to hygiene in factories, contained in the hygienic code of 1879, there is also a special ordinance in Finland for protecting the workmen in various trades (*Förordning angående skydd för arbetarene i de industriella yrkena*), dated 15th April, 1889. It contains the following regulations: Workrooms and workshops for the different trades must be arranged so as to give each worker sufficient space and pure air. They must be properly lighted, as well as the corridors and staircases.

All places used by workpeople must be kept clean and in good order.

Considering the danger of fire, each workroom must have several doors, according to the number of persons employed, so arranged that the room may be cleared without difficulty. Trap-doors, stairs, etc., must be surrounded with a balustrade.

Special precautions must be taken for preventing or neutralizing the effects of unhealthy exhalations or dust from the work.

Machines, etc, scaffolding, and other apparatus employed in the different industries must be kept in good repair, and the parts in motion protected so as not to endanger the lives or limbs of the workpeople.

Every manufacturer is bound to take all precautions rendered necessary by the nature of the work for the protection of the health and lives of his workpeople, while it is the duty of the Senate to make more detailed regulations for carrying the above rules into execution.

Special regulations for the working of mines and inspection of steam-boilers are in force.

Children under twelve years, children and young people of weak constitution, to whom industrial work might be injurious, must not be employed in factories, trades, or other industries.

Manufacturers employing persons under age must obtain a certificate of age given by the pastor.

The inspector is authorized to require a declaration from the doctor if necessary stating at what point work becomes hurtful to the persons before mentioned.

The terms, "children and boys," used in this order indicate persons under fifteen; the term, "young people," includes those from fifteen to eighteen years old.

In mines, factories, works, etc., children and young people must only work between the hours of 5 a.m. and 9 p.m. The working day must not

exceed seven hours for children, and fourteen hours for other workpeople, including intervals for rest.

Children at work until noon must not return to work the same day after 1 p.m.

The intervals of rest must be so arranged that the young people have two hours of recreation, and the children half an hour; the first interval must be four hours, and the second nine hours after work has begun.

During these intervals children and young people are forbidden to work, and they are not allowed to remain in the workshops unless work is entirely suspended in the part which they occupy, or when the inspector of factories has given his consent to their doing so.

The Senate determines under what conditions children and young people may be employed in industries and branches of industries which endanger health or are attended with excessive fatigue.

The Council of Industry (*Industristyrelsen*) may authorize the following relaxations of the above-mentioned regulations :—

1. Managers may obtain permission to employ children for the same time as young people on condition that they are occasionally excused from all work for a day or two.

2. In industries which require continuous night-work which will not permit the division of the workpeople into alternate groups the managers may be authorized to employ young people and children at other hours than those mentioned above.

Guarantees for security must be given, and it must be shown that the industry cannot be carried on without such an arrangement.

3. A lengthening of the working day may be permitted for a certain time either under the head of a general rule in favour of an industry which is less active at one time than another, or in a particular case when an accident has suspended the regular order of the establishment, or an unforeseen event occasions unusual pressure. This last concession may be accorded by the inspector for three weeks.

Children and young women must never be employed in underground work in mines or quarries, and they must not grease or clean machinery in motion.

The time during which children and young people may be employed in different trades and industries other than factories must conform to the following regulations of the 31st March, 1879 :—

"Children under fifteen must not be compelled to work more than eight hours a day, including the intervals for rest.

"Young people under eighteen must not work between 9 p.m. and 5 a.m. without permission from their guardian and a declaration from a doctor certifying that the work will not endanger health.

"For this purpose every worker under age must undergo a medical examination at least once a year."

Children employed in factories and trades, who have not completed the course in an upper primary school, or some similar establishment, must

receive regular instruction during at least twelve hours in the week. Managers are responsible for all infractions of this rule.

Municipal authorities must take such measures as are necessary for organizing instruction; in the country managers must engage teachers if there is no other way of giving the children the necessary instruction.

All managers employing young people under eighteen must have them enrolled in a register in which are written, according to a form prepared by the Council of Trade, the names, places, and times of birth; for children the names of the parents or guardians must be added, as well as the time of school attendance. This register and the certificates of the doctor and pastor must always be accessible to the factory inspector.

In every factory and workshop there must be fixed in a suitable place in the two languages of the country (Swedish and Finn): 1st, An extract from the regulations drawn up by the Council of Trade, to which are added rules applicable to each particular industry; 2nd, the hours at which work for children and young people begins and ends, the times of rest being mentioned; 3rd, the name and address of the factory inspector (*yrkes-inspektor*).

The supervision of this regulation devolves on the inspectors of factories, each of whom has his district, under the superintendence of the Council of Trade.

The number of inspectors and the bounds of their districts are determined by the Senate, which regulates the work of these officers by special instructions.

Commissions of Hygiene and Communal Councils are bound to second the inspectors, and the superintendence of trades is generally exercised through them.

Inspectors can demand all necessary information from the doctors of provinces, towns, communes, and from the delegates of workmen's and trade associations; they may also demand the assistance of municipal and rural authorities.

The factory inspector must have access to all factories, workshops, and other places where work is carried on in his district. On his visits he is authorized to demand any information from the persons employed in them; he may also make all necessary investigations in the fulfilment of his duties.

If any establishment does not comply with the conditions imposed, the inspector must require the manager to remedy the defects within a fixed time and in the manner he directs. A notice of this kind may be submitted to the judgment of the Council of Trade within thirty days, and if its decision is against him, the manager may make an appeal to the Senate.

The inspector must write in a register all his observations on the manner in which the regulations are observed, send the reports he has prepared, and furnish an extract to the manager if he requests it, or if the inspector considers it desirable.

The inspectors of factories must not possess nor direct any establish ment; nor be interested in any company having an industrial aim; nor be holders of any patent for the processes, machines, or apparatus used in these establishments.

Inspectors must also keep the secret of technical processes which may come to their knowledge through their position unless duty obliges them to give information.

When any member of an establishment meets with a serious accident while working, the manager must inform the Bureau of Police and the Rural or Municipal Authority, who will at once make an inquiry and inform the inspector of the result.

The Council of Trade, which is a special committee, is instituted to promote the interests of trade. Its members must satisfy themselves by inspection that the regulations are properly observed.

CHAPTER II.

HELSINGFORS.

General Remarks.—Sanitary Administration.—Sanitary Legislation.—Sanitary Arrangements relating to Air.—Sanitary Arrangements relating to Water.—Provisions.—Sanitary Arrangements relating to the Ground.—Cleansing.—Drainage.—Privies.—Stables.—Abattoir.—Preventive Measures against Infectious Diseases.—Vaccination.—Isolation and Treatment of the Sick.—Disinfection.—Mortuaries.—Burial Places.—Prostitution.—Public Buildings.—Hospitals.—Workmen's Houses.—Hygiene of Factories.—Hygiene of Schools.

General Remarks.—The country of Finland, which is so distant from the rest of the world, and so little known, is extremely picturesque, and its capital is beautifully situated.

Helsingfors is built on a peninsula which runs into the Gulf of Finland, in latitude 60°·10 north; and is washed on three sides by the sea, which extends in an unbroken expanse to the horizon in the south, and towards the east and west forms several bays running far into the land, adorned with many small islands. The shores are generally barren, precipitous, and rather high. The ground is undulating.

The city dates from the 17th century—its actual construction from 1812, the time at which it became the capital.

Not long before this, in 1808, the city was ravaged by a great fire, after which it was rebuilt without difficulty, as in the old town the houses were small, and made of wood.

The city has an area of 1,692 hectares. In 1889 one-third of this space was occupied by buildings.

In the central part the houses built of stone have several storeys; in the more distant quarters they may be of wood, with one storey only. The total number of houses is about 3,000 for a population of 60,000 souls, which gives an average of twenty inmates for each house.

Latterly speculation has encouraged a style of building consisting of large houses with confined yards and areas, a system which has been possible because of the deficiency of regulations for building.

The authorities have already recognised that this system is a bad one, and steps have been taken towards the establishment of new regulations more in harmony with the requirements of hygiene. The proof that some change is necessary is found in the high mortality from tuberculosis, which forms 21·5 per cent. of the total deaths in Helsingfors.[1]

[1] In Vienna it is 26 per cent.; in Paris, 16; in London, 15; in Stockholm, 14; and Berlin, 13. (The statement of deaths from tuberculosis as a percentage of total deaths is not free from fallacies.—*Transl.*).

For a city so favourably situated, the general mortality is also too high. The following figures, however, show an improvement in hygienic conditions. The mortality per 1,000 persons was :—

26·8 from 1874 to 1878.
25·1 from 1879 to 1883.
22·9 from 1884 to 1888.

All affairs relating to the administration of the city are entrusted to the care of the Municipal Council (*Stadsfullmäktige*), according to the general law of the country. Delegates from the city are elected for three years.

Ordinary affairs are managed by Commissions appointed for this purpose. The Health Commission forms part of this organization.

These various Commissions are subordinate to the Aldermanic Council (*Magistraten*), which forms the government of the city, and must see that the decrees issued are duly executed.

The Aldermanic Council is composed of a Burgomaster and Aldermen appointed for life. The first must be a lawyer, and he must be present at the sittings of the Municipal Council. He has a consultative vote in the Council, and may put a veto on any decision which he judges contrary to the laws in force. An appeal may be made from this veto to the Prefect (*Guvernör*), and from him to the Senate.

Sanitary Administration.—According to the regulations of the Hygienic Code, the direction of the public health and hygiene belongs to the Health Commission (*Helsovårdsnämnd*), composed of the town doctor, the head of the police, and the town engineer, who are members *ex-officio*, and five delegates from the Commune, elected for two years.

The Commission maintains a laboratory for the analysis of foods and drinking-water, also two officers of health (*Helsopoliser*), one of whom is charged with the inspection of foods; the other with the inspection of houses, yards, furnished lodgings, the abattoir, the latrines, sewers, etc. Disinfection is also under his jurisdiction.

In the superintendence of the Commission for public roads and streets, the Health Commission (*Helsovårdsnämnd*) is assisted by the administrative police, especially in all that concerns streets and public places.

There are five district doctors (*Distriktsläkare*), one of whom is a woman. They are entrusted with the care of the sick poor under the auspices of the Commission.

Vaccination and prostitution are not in the department of the Commission; the first belongs to the Medical Council (*Medicinalstyrelsen*), the other to the same Council and the general police.

Cases of infectious disease are notified by all doctors in practice to the town doctor (*Stadsläkare*), who publishes a list of the new cases every week.

A statement of the sanitary condition of Helsingfors is also given in the *Weekly Bulletin* at Brussels.

All deaths must be registered at the pastoral bureau, and must be

accompanied with a statement of the cause of death made by the doctor who has attended the patient. These certificates are afterwards sent to the town doctor.

Sanitary Legislation.—In conformity with the Code of Hygiene, Helsingfors has established special sanitary regulations. At present, however, these only include directions for the Health Commission.

These directions are really no more than an amplification of the Hygienic Code. In many points they limit the powers and duties which that law gives to the Health Commission.

Besides these directions, there are also certain sanitary rules included in the police regulations for the town, and in the regulations for buildings.

Sanitary Arrangements relating to Air.—As Helsingfors is situated on open ground, washed by the sea, which in many places runs far into the land, it enjoys the inestimable advantage of a constant current of fresh air. The town is well provided with streets and squares of sufficient size.

There is no want of public parks and promenades, whose extent and natural beauty are celebrated.

The most remarkable of these is the "Esplanade," which extends from the southern gate to the western boundary. Among smaller plantations, the "Place Elizabeth," the square of the Palace of the Lords (*Riddarhussqvären*); the gardens of the churches (*Kyrkoträdgärdene*); the factory park, the square park, and others may be noted.

The two large parks of Kaisaniemi, with the botanic gardens near the Bay of Tolo to the north, and the Brunns park on the seashore to the south, are distinguished by their extent, beautiful walks, and magnificent views. Hesperia, the Djurgård, the islands of Hoegholm, and Fölisön, are also fine parks which adorn the suburbs of the city.

Although the climate is so salubrious, the closely built parts are unhealthy. This is caused by the building of large houses with confined courts, a fault which will be avoided in future erections now that new regulations for building have been issued.

Arrangements for ventilation in large private houses have also been completely neglected.

Two things help to vitiate the air: the cleaning of streets and yards without previous watering, and the system in use for latrines and sewers.

The Hygienic Code for Finland, which is nearly a copy of the Swedish Code, does not contain any regulation for the ventilation of public places, but government has given orders for the establishment of proper ventilation in schools, barracks, and hospitals.

The system generally used is that of central heating, combined with ventilation, either by means of hot air or hot water.

The most simple systems are most in use, such as those which have aspirating shafts for abstracting the vitiated air, and stoves with casings or direct openings for the introduction of fresh air.

In the new law for the protection of the workmen in industrial callings,

there are regulations for the ventilation of factories. Similar regulations have been established for the city of Helsingfors by the police order of 29th March, 1878.

Attention has also been paid to workmen's dwellings. It is enacted that owners must provide healthy dwellings for their workpeople, and that care must be taken to avoid overcrowding.

The Health Commission must direct the arrangements necessary for this purpose; it must also endeavour to get rid of any local nuisance dangerous to health. The owners or the tenants of these dwellings must conform to the injunctions of the Commission under penalty of a fine varying from ten to fifty francs.

Houses in Finland require a great deal of heating, as the winter is long, the average temperature from December to February being $-8°$ C., sometimes falling to $-40°$ in the interior of the country further north.

Heating is managed by stoves usually made of earthenware, furnished with ascending and descending pipes, through which the products of combustion must pass in communicating their heat to the room.

Wood is burnt in the stoves, and they are usually fed from above.

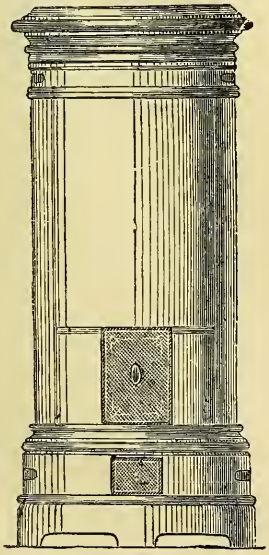


FIG. 170.
ANDSTEN'S STOVE.

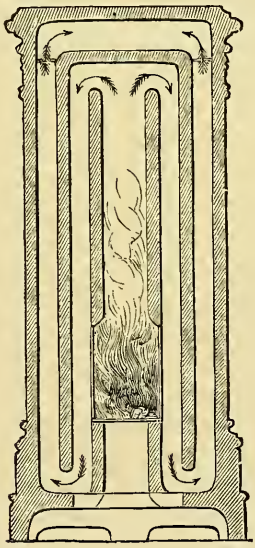


FIG. 171.
VERTICAL SECTION OF THE FRONT OF ANDSTEN'S STOVE.

M. Andsten, a manufacturer at Helsingfors, has constructed an economical stove shown in Figs. 170 to 173.

Fig. 170 shows the exterior form; Fig. 171 gives a section of the front; Fig. 172 a lateral section; and Fig. 173 shows a transverse section of the smoke-pipes.

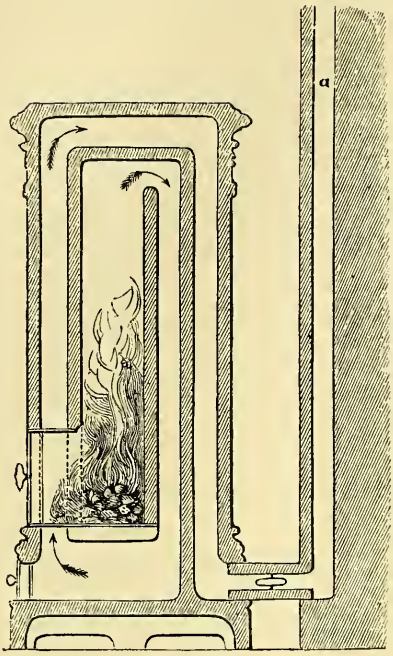


Fig. 172.
View of Lateral Section of Andsten's Stove.

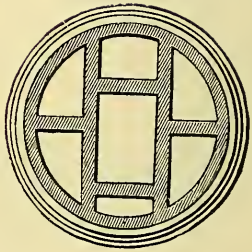


Fig. 173.
Plan of Andsten's Stove.

The smoke-pipe opens below into a flue in the wall. By fixing at the point *a* an outlet-pipe for vitiated air (see Fig. 172), and openings for the introduction of fresh air, according to the systems of Boyle or Tobin (see Figs. 27 and 28), thorough ventilation is easily obtained.

Heating and ventilation for railway carriages has been organized in an ingenious manner by M. Mohring, an engineer at Helsingfors (see Figs. 174 and 175.

The floor of the carriage is double, so constructed that the intervening space forms the chamber *a*, where the air is heated. This space is enlarged from top to bottom towards the middle of the carriage, where it becomes large enough to permit the introduction of a calorifer. The upper floor is pierced with openings (*b*) covered with small wire through which fresh air can pass. Other openings (*c*), covered in the same way, are made in the lower floor beside the calorifer, and serve to bring fresh air into the heated chamber.

The calorifer consists of a cast-iron stove (*d*), with exterior wings; a grating with an ash-pan below (*e*); towards the top it communicates with the chimney (*f*); this has a casting of sheet-iron (*m*) provided at the upper part with a valve (*n*), which may be opened when it is very cold to raise the temperature of the carriage.

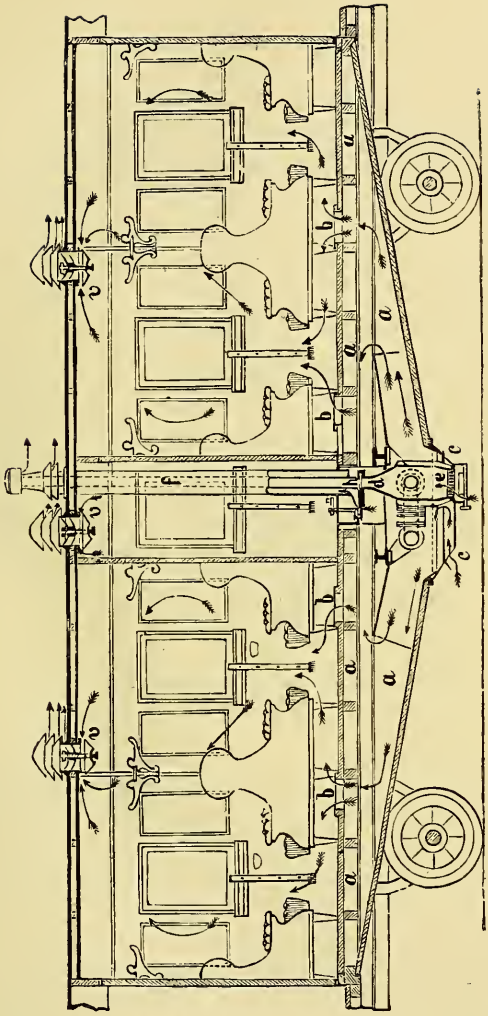


Fig. 174.—Heating and Ventilation of Railway Carriages (Mohring's System), Longitudinal Section.

The air penetrates to the inside of the carriage between the casing and chimney. When it is not very cold this air passes out above the roof, and assists ventilation. The casing is also useful in guarding against all danger of fire, and excessive radiation of heat. The chimney has a wicket (*o*), from which the inside of the stove may be seen.

The fuel, which may be coal, coke, wood, or turf, is put into the chimney by an opening (*g*); the upper part of the stove may be shut by means of the key *h*. A discharge-pipe in cast-iron is connected with the stove; it bends round the stove and opens above the key *h* into the shaft, where a regulating valve is placed.

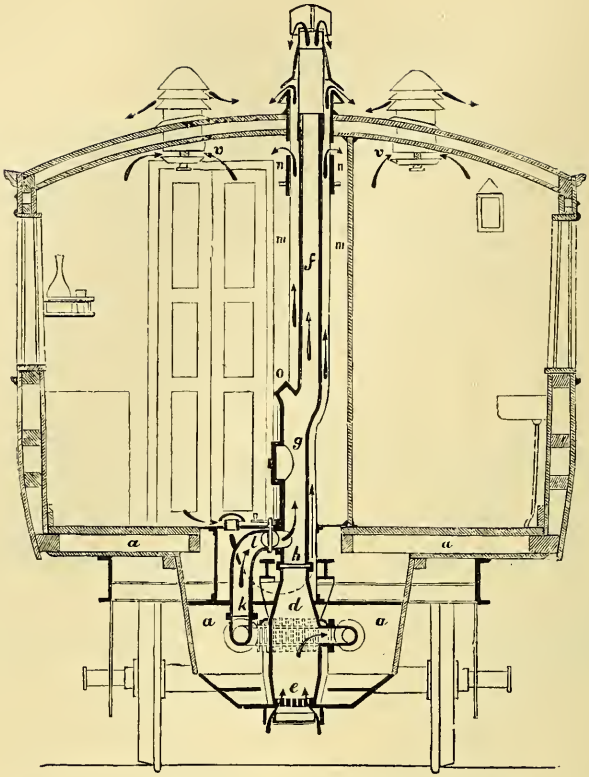


Fig. 175.—Heating and Ventilation of Railway Carriages (Mohring's System), Transverse Section.

In order to light the stove, the valve *l* is shut, and the key *h* opened. A small quantity of wood is put in at first, afterwards more, until the stove is full; the key *h* is then shut, and the valve *l* re-opened. The products of combustion are forced out through the pipe *k*, which is thus heated, and assist the stove in heating the hot-air chamber from which the warm air ascends into the carriage through the opening *b*.

The vitiated air escapes by valves (*v*) placed in the roofs of the carriage, and provided with Wiman's aspirator (see p. 458).

The temperature is regulated by the thermometer. It may be maintained without difficulty at 15° C., even on the most northerly railroad, that is, the line ending at the town of Uléaborg, where the temperature sometimes reaches −35° C.

During winter the carriages are provided with double windows, and all, even the third class, have calorifers and lavatories.

Sanitary Arrangements relating to Water.—Helsingfors has possessed a water service since 1877. The water is brought from the Vanda, which flows about 6 kilomètres from the city, and is filtered through sand.

A hydraulic engine raises the water into a granite reservoir built on the mountain of Djurgârden, and it arrives in the city by simple gravitation.

The large pipes are made of cast-iron. Inside the houses the use of wrought-iron is permitted. Lead pipes are forbidden except in factories and industrial establishments, where the water is not used for cooking or drinking, or where it is distilled.

The connection of private houses with the service pipes is not yet enforced.

The payments for water are either reckoned at so much for each room (as in Stockholm), or a meter is used. In the first case, the price is calculated at about 4 francs per room.

The consumption is at present about 55 litres per day for each person. There are fountains for the use of the public in several parts of the city, and supplies for the public urinals or fires. The water service is the property of the city. The river from which the water is taken flows partly through marshes, partly through cultivated fields; but even after filtration it remains turbid and brownish in colour. According to the analysis of Eckendahl, of Stockholm, it contains :—

	Organic Carbon.	Organic Nitrogen.	Nitrates and Nitrites.	Ammonia.	Total Nitrogen.	Oxygen consumed.
Unfiltered . .	2·08	0·155	0·007	0	0·162	1·84
Filtered . . .	1·79	0·151	0·007	0	0·158	1·56

Several methods for improving the water are shortly to be tried. The effects which might be produced by the employment of filtering beds of greater thickness, slower filtering and less pressure, are under consideration. It is also proposed to purify the water by the apparatus invented by the engineer Anderson, of London, called the "revolving purifier." This is composed of a sheet-iron cylinder holding a certain quantity of iron filings. The water comes in at one end of the cylinder, remains during four or five minutes in contact with the iron filings; then flows at the other end of the cylinder into a trench, where it is impregnated with air by means of a blast engine; it then falls into a basin, where it remains from six to ten hours that the iron oxide may be precipitated; lastly, it passes through an ordinary sand filter where purification is completed. This method decomposes organic substances; when in contact with the iron, carbonate of iron is formed, which becomes decomposed on exposure to air.

The system in use in Antwerp, and in several other cities, only adds about 1·80 francs per 1,000 cubic mètres of water to the cost of purification.

A very simple method of aërating water is that invented by the engineer Söderqvist, of Helsingborg, in Sweden. He causes the water to flow over screens of sheet-iron in the form of umbrellas, having a diameter of 1·80

mètre, placed horizontally at the upper end of the vertical pipes through which the water flows.

The engineer Hansen, of Helsingfors, has proposed the combination of Anderson's purifier with Söderqvist's screens so as to render the blast of air unnecessary.

Foods.—The Hygienic Code obliges all the city communes to establish "special regulations suitable to local conditions and needs, containing not only directions for the Health Commission, but also rules for the inspection of lodgings, the organization of drainage, of industries dangerous to health, and in general all matters relating to public hygiene."

The inspection of provisions is undoubtedly included in this category. Helsingfors does not yet possess any special regulations for this purpose, except some general rules prescribed by a police order of the 29th March, 1878, for the maintenance of cleanliness where meat and fish are sold.

The Municipal Council, in its sitting of the 3rd December, 1889, decided that regulations as to foods should be prepared and a Bureau of Hygiene instituted.

A new market for the sale of provisions has been built since 1889, but the principal markets are still held in the open air in public squares.

For regulating the sale of milk, the Urban Commission (*Stadsfullmäktige*) adopted regulations similar to those in force in Sweden on the 18th November, 1889.

The prefect, in conjunction with the Aldermanic Council, has made the following rules for bakers, confectioners, pastry-cooks, and pork-butchers, as a supplement to the Helsingfors police regulations.

1. The places where work is carried on must always be kept clean, also depôts, stores, passages, ante-rooms, etc. For this purpose the walls and ceilings must be painted in oil, or limewashed every year, and the floors made of materials which can be cleansed without difficulty.

2. All these places must be thoroughly ventilated.

3. Persons working at these trades must always be very clean; bakers and confectioners must wear white clothes which can be easily washed. Pork-butchers must wear similar aprons.

4. Work-rooms, depôts, and stores must never be used as sleeping-rooms, and they must not be placed in passages leading to workmen's lodgings, nor be in communication with them.

5. All the above-mentioned places must be protected from the air of sewers, latrines, and other injurious influences.

6. All the implements in use must be frequently cleaned with the greatest care, and the ingredients used must be of the best quality.

7. If there is a sink in the premises, it must receive special attention, also the floor and walls.

Arrangements relating to the Ground.—Cleansing.—With few exceptions the streets of Helsingfors are paved with pebbles, and this state of things is not easily remedied, the less so as the city does not take in hand the care of the streets, but leaves it to the neighbouring owners.

The inconveniences occasioned by this kind of paving are numerous from the sanitary stand-point: dirt is easily introduced into the unequal interstices of the stones; dust accumulates, and is blown about by every breeze, corrupting the atmosphere; finally, it is impossible to clean them thoroughly by watering.

Cleaning of the streets near private houses is managed by their owners. Public places are cleaned by contractors at the expense of the city.

Sweepings and refuse from the yards may be deposited in latrines, manure pits, or in chests placed for the purpose. There is no regulation for emptying them, consequently large heaps are sometimes seen in the yards. The police order of 1878 only enjoins that they must not be allowed to accumulate too much, but must be deposited in small quantities in places set apart in the territory of the city, or beyond the suburbs.

Refuse must be removed during the night in water-tight carts. In summer a large quantity is loaded on to covered barges, and taken to farmers who have contracted for its disposal.

Drainage.—The system of sewers dates from 1878. It consists of pipes of small diameter, some made of brick, others of glazed pottery, conducting the sewage to the sea.

Little is done for their ventilation, and there is no flushing. The unsuitable position of the outfalls causes great nuisances, and makes new arrangements necessary.

The regulations concerning the drainage-pipes of houses are equally defective, especially as there is no inspection at the time they are made, or subsequently.

As in other branches of public hygiene, no improvements can be expected until sanitary regulations are established, such as those prescribed by the Hygienic Codes, and a Bureau of Hygiene is opened.

Privies.[1]—The primitive system of cesspools has not yet been abandoned in Helsingfors. There is a considerable number of latrines in the yards, and they are generally joined to the stable, the manure being discharged into the same pits. These are sunk in the ground, and the closets are placed at a certain height above them.

The regulations for buildings enjoin that the pit shall be water-tight, that is, made in cement, or covered with planks well joined and tarred inside. They must be so arranged as to be easily emptied and properly ventilated by means of a shaft rising above the ridge of the roof.

In those parts of the city which have no sewers, the same pit also receives the waste water.

Cesspools which cannot be made or kept water-tight are to be condemned from the sanitary standpoint. At Helsingfors they are much too large, and

[1] The Municipal Council in 1892 resolved to suppress the system of privies in Helsingfors, and to introduce earth-closets. The pails are required to be placed above the ground-level, and the ground to be impermeable. The cleansing of these will be done by the town authorities.

diffuse a strong odour, forming the principal cause of the unwholesome air noticed in crowded houses.

In apartments occupied by persons in easy circumstances, closets are in general use, provided with separate movable receptacles for solid dejecta and urine. This apparatus is not objectionable when kept in good order and ventilated.

Owing to ignorance much hesitation has been felt as to the introduction of water-closets into the houses. But as the Health Commission has expressed approval of them, it may be hoped that these unreasonable apprehensions will soon be dissipated.

Stables.—There are no regulations in force concerning the construction and management of stables.

Abattoir.—A public abattoir has been built by a private company in an open space in a bay of the sea, to which is attached a tripe-shop and a candle factory.

The building is on the same plan as the markets, and includes two large abattoirs separated by a scalding-house. The intestines of the animals are put into a separate room adjoining the building, and thence taken to a covered place at some distance from the abattoir, where they are mixed with lime.

The abattoir is made of wood with a floor of asphalte. The floors have gutters in the centre, and slope towards the sea to which the water used for cleansing flows directly.

On the same ground is a stable for animals to be slaughtered, and at a little distance is the house for the inspector and workpeople.

Although this establishment is still defective, its existence indicates great progress in the interests of the public health.

At present there is no general regulation for the building of abattoirs, their construction and inspection. All these subjects are included in the special regulations for the city.

Cattle are not yet submitted to inspection before slaughtering. Meat is not inspected before it is put on sale.

Up to the present it has not been considered necessary to have a cattle market annexed to the abattoir. Animals are bought in the country and taken to farms near the city whence they are removed to the abattoir.

Preventive Measures against Infectious Diseases.—Vaccination.—The depôt for vaccine at Helsingfors is superintended by the city doctor, and vaccination is placed under the immediate supervision of the Medical Council.

Vaccination is performed by the chief of each depôt and his assistant-vaccinators.

The chief must keep a constant supply of vaccine that he may be able to provide it at once when required by the communes in his district.

He must instruct any who desire it in the art of performing vaccination, and subsequently give them a certificate of competence. Arrangements have been recently made for providing the depôt with animal vaccine.

Isolation.—Treatment of the Sick. — The measures actually in use for preventing the spread of disease do not satisfy present requirements.

The city hospital contains only 30 beds, but as 1 per 1,000 of the population is usually considered necessary, it follows that 60 beds would not be too many.

This hospital was opened in 1886. It includes two large wards with 12 beds in each; one ward for each sex, and four smaller rooms.

Ventilation is managed by openings made in the wall, and by stoves with casings. A common chimney-shaft with which all the rooms communicate carries off the vitiated air.

This system, and the arrangement of the wards side by side, do not accord with the general principles to be observed in hospital buildings.

The inconveniences are mitigated by the splendid situation of the establishment, on a mountain by the side of the sea, and by its large extent, covering a space of 38,000 square mètres.

A building for domestic offices and a laundry adjoin the hospital. There are no special carriages for the conveyance of infectious patients.

Disinfection.—In 1888 a house for disinfection was built by the city authorities. It is provided with a stove made by Schimmel de Chemnitz, similar to the system of Geneste and Herscher, of Paris.

The building is composed of a place for disinfection, divided by a middle wall into which the stove is fitted, so that the side on which the infected clothing is put in is completely separated from that on which it comes out purified. The first of these rooms communicates with a bath-room for the use of the staff of the establishment.

Disinfection of private houses is managed by the health police according to the directions of the city doctor, but regular and compulsory disinfection has not yet been introduced.

Mortuaries.—Burial Places.—There are no mortuaries in Helsingfors to which the bodies of persons who have died in a crowded house can be removed. In order that the regulations of the sanitary law may be carried out, it is proposed to acquire a piece of ground about 12 kilomètres from the city for a new cemetery.

Permission to lay out a new cemetery must be obtained from the Senate. With this application must be sent a plan of the ground indicating the nature of the soil, the distance from the nearest houses, the position and direction of flow of neighbouring streams and wells. This information must be accompanied by a report from the provincial doctor as to the suitability of the site from the standpoint of the public health (Circular of the Senate of the 15th April, 1886).

Prostitution.—As we have already remarked, prostitution does not come under the jurisdiction of the Health Commission (*Helsovårdsnämnd*) but is regulated by the Medical Council (*Medicinalstyrelsen*) and the administrative police. It is superintended by a special bureau including a medical department and a police department. The first is represented by

the Medical Inspector; the second is under the direction of the Commissioner of the detective police, assisted by two officers.

The duties of the Commissioner are as follows :—

To send to the police bureau a report on the inspections;

To send to the hospital *ad hoc* all women found to be suffering from venereal disease, and any who are suspected to be so suffering;

To register, according to a special form, all women who ought to be subjected to inspection, to erase the names of those who have died or have left the city, or give guarantees that they will renounce prostitution;

To inform against women suspected of leading a vicious life, notice the irregularities of registered women, and bring to the bureau any who have neglected to submit themselves to inspection, or who require a special inspection;

To send to the Commissioner of the district every three months a list of persons registered at the bureau, with their addresses;

To send a list of the women to the doctor on the days for inspection. The Medical Inspector, who is appointed by the Medical Council, must present a monthly report on the number of women registered at the bureau in the course of the month, the number of persons diseased or supposed to be so, the number of persons sent to the hospital, etc. He should add to this report any observations likely to be of service to the public health.

Inspection is made once a week.

Public Buildings.—Hospitals.—In the last twelve years a number of public buildings, schools, hospitals, barracks, etc., have been erected in Helsingfors, in which some attempt has been made to meet the requirements of hygiene.

In the endeavour to attain such perfection as is possible, the choice of too complicated systems has often been made, especially for heating and ventilation.

Public buildings have all the great advantage of being built on sufficiently large sites. Several of these,—the new hospital for surgery, the lying-in hospital, and the city hospital,—are so favourably situated that few establishments of the same kind can compare with them. All these are built on a granite formation, in an open space with a view of the sea.

The new hospital for surgery, which was opened in 1888, is on the west side of the Observatory Hill, and occupies a space of 21,000 square mètres. It is composed of four pavilions of different sizes, each having two storeys, and a pavilion for isolation, with a total accommodation for 154 patients; the domestic offices are at the side, separate from the pavilions.

Two of the large pavilions have two wards containing twelve beds on each storey. The wards are separated by a large room which serves as a dining-room, and by four small wards each containing one bed; the smaller pavilions have four rooms.

The pavilions are connected by corridors on two storeys.

The pavilion for isolation contains six rooms and fourteen beds.

The floor of the rooms is waxed parquet, in small squares of oak; the

floors of the corridors and dining-room are asphalted; and the vestibule is in mosaic stone, 50 cubic mètres are allowed for each bed, and the ventilation is at the rate of 75 cubic mètres in the hour.

The ventilation of the hospital is effected by means of a system of expulsion and aspiration.

Fresh air enters by a little tower, and is drawn by bellows into an air-chamber in the ground floor, whence it is driven by the same blast into pipes opening into the wards.

In summer the air introduced is filtered across screens of cloth arranged in zigzags.

In winter the air introduced is directed over a stack of steam-pipes, and has a temperature of about 17° C., when it enters the wards.

The current of air has a velocity of 5 to 6 mètres a second.

Besides the warm air introduced by the ventilating apparatus, each pavilion is heated with hot water.

The water is heated by steam issuing from a boiler, common to the whole hospital, but the apparatus for each pavilion may also be heated separately. When the propeller is at work, it is not necessary to warm the aspirating channel.

The two systems may thus be put in play apart from each other.

The latrines are provided with movable tanks and separate drainage for the urine; the tubs placed in vaults on the ground floor are put in a chamber of masonry hermetically closed. The top of this chamber is provided with a ventilating-pipe about 30 centimètres in diameter, which is carried above the roof, the air in it being warmed by means of a petroleum lamp placed inside.

Between the pan, which is made of iron, painted white, and the wooden seat there is a space of two centimètres by which the air is drawn downwards, and into the discharge-pipe, whence it escapes by the pipe mentioned above.

The closet has a window opening on the fresh air. Each pan has a discharge-pipe. The system is considered satisfactory.

The hospital possesses a disinfecting establishment with a stove on Schimmel's system.

The lying-in hospital, situated to the south, on an elevation near the hospital for surgery, occupies a site of 30,800 mètres. It includes four detached pavilions, one of which contains six rooms with one bed in each; two others have wards for eight to ten beds separated by a room for delivery containing three beds; the fourth pavilion, which is reserved for emergencies, contains only two rooms and five beds.

In the large wards 50 cubic mètres of air are allowed for each bed; in the small ones 75 mètres: the air is renewed at the rate of 75 and 125 mètres per hour for each bed.

This establishment is distinguished from the others by its simple and effective system of heating and ventilation by means of stoves with casings and by aspiration.

The stoves in the large rooms have a casing of sheet-iron, and are fixed in couples near the outside wall.

In the smaller rooms they are made of earthenware. The vitiated air escapes by pipes which open in different parts of the room, pass under the floor and unite in a ventilating-shaft placed in the middle of the inside wall, and heated by a slow combustion stove. In front of the shaft and connected with it is a common stove, which is heated during the winter.

Each of the large wards has a separate aspirating-shaft, so that its ventilation is independent.

Ventilation by the windows has had special attention. Ventilators 40 centimètres in diameter, closed by movable valves, have been placed in the wall above and below each window in order to ensure a complete renewal of air in the wards.

These pavilions have been constructed half in brick and half in wood, that it might be ascertained whether the materials employed in building had any influence on heating, ventilation, and other sanitary conditions. Since the building of the lying-in hospital in 1878 no great difference in these respects has been remarked. The wards constructed of wood are lined inside and out with planks painted in oil, those of brick are plastered and painted with oil inside. The wood used is deal.

The ordinary pavilions have closets with movable tanks. The walls and floor are cemented and provided with ventilators. In these closets are portable receptacles for the contents of the bed-pans used by bedridden patients. These receptacles, which hold about 25 litres, are emptied every day.

In the pavilion for emergencies is a kind of closet invented by the engineer C. Hult, by means of which the excreta are burnt. The apparatus is shown in the following figures :—

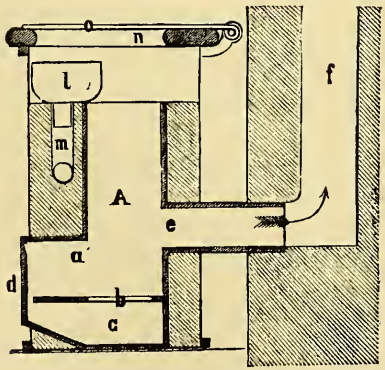


FIG. 176.—HULT'S CLOSET (VERTICAL SECTION).

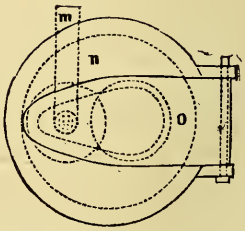


FIG. 177.—HULT'S CLOSET.

A. Receptacle for excreta—*a*. hearth. *b*. Grating. *c*. Ashpan. *d*. Door of fire. *e*. Pipe for smoke. *f*. Chimney. *l*. Pan for urine. *m*. Pipe for urine. *n*. Wooden seat. *o*. Iron lid.

It is faced with sheet-iron within and without. The space between the iron cylinders is filled with cement. The urine flows away separately.

Each time that the apparatus has been used sticks or shavings [1] are thrown in; when full, the wooden seat is removed and an iron lid substituted; the fire is then lit, and in a short time the contents are burnt.

The fireplace makes this closet a little higher than those in ordinary use. It is reached by steps.

Workmen's Houses.—It is thirty years since the first dwellings for workmen were constructed in the Villa Lugnet, Rue de Lapprick. Since then a considerable number have been built in different parts of the town.

As no building regulations are in existence, the requirements of hygiene have not always been considered in these dwellings; most of them are constructed of wood. They have two storeys, and are divided by corridors.

Lately other dwellings have been erected, which are cited as models from the hygienic standpoint. Among these may be mentioned the group belonging to the company *Arbetaranesi Helsingfors Bygnadsakliebolag*, constituted of workmen and other persons entrusted in the enterprise, and the buildings erected by the associations Aiku and Taimi, composed exclusively of workmen.

The first of these groups, including 20 dwelling-houses, is situated between the streets Graesviksgatan, Barnhemsgatan, Arbetaregatan, built on a site of 12,500 square mètres close to the sea.

The arrangement of the buildings is shown on the plan of Fig. 178. The houses built of wood have one storey only, and include from 4 to 6 tenements, composed of a room with kitchen arranged as in Figure 179.

There are 98 tenements in the group.

The rooms are heated by earthenware stoves provided with ventilating-pipes for the escape of the vitiated air.

Fresh air enters by the windows, one sash of which opens; it is forbidden to fasten this up in winter.

Each tenement is isolated, has a separate staircase, a garret, a cellar, and a closet. The latter is a vaulted room in the basement. It is entered from the outside and lighted by a small window. The excreta fall into a movable tank.

A large ventilating-pipe rises from under the seat to the kitchen chimney, and is continued with the smoke-pipe above the roof. This secures so thorough a draught that there is no unpleasant odour.

Each tenement has its small garden and share of the open space reserved between the houses. The general aspect of the place is made singularly pleasing by the various modes of cultivation. The company has taken care to plant trees in each inclosure.

The laundries and bake-houses are in a separate building (*b*), near which a place is reserved for solid refuse. This depôt is too large and too deep

[1] Turf or peat may also be used.

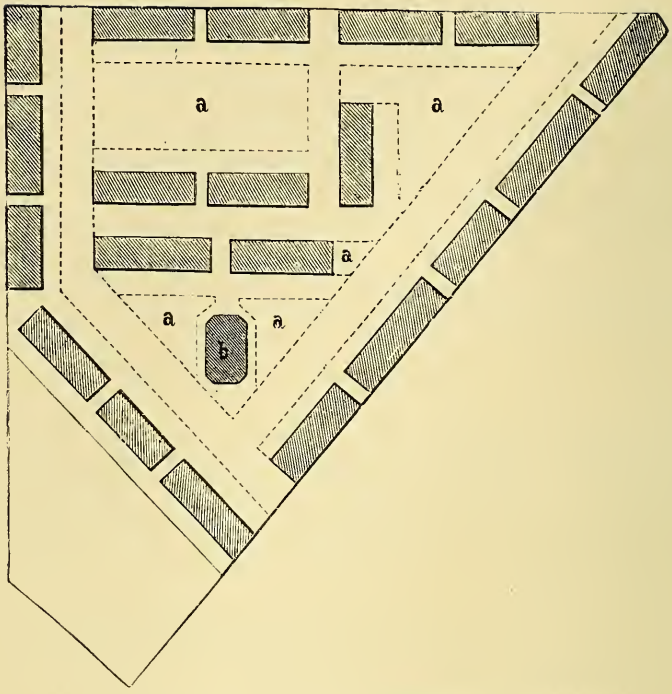


Fig. 178.—Plan of a Group of Workmen's Dwellings.

a. Garden. *b*. Laundry and bakehouse.

(a defect in construction very common in Finland), the refuse is accumulated in too large quantitities, and its cleansing is difficult.

There are drains for waste water in the court communicating with the sewer by a pipe. The drains are too large and too near the basement.

Water-taps are placed in the court.

As yet there is no legal regulation determining the space to be allowed for each person in workmen's houses. It is the duty of the Commission of Health (*Helsovårdsnämnd*) to decide in each particular case.

According to the statutes of the above-mentioned company, the same tenement must not be inhabited by more than seven persons belonging to the same family, children counting equally with adults.

Each tenement occupies a space of from 80 to 90 cubic mètres. The height of the rooms is from 2·90 mètres. The rent is about 26 francs a month.

There is a resident superintendent, who is responsible for the good order and cleanliness of the premises.

There is no regular inspection of lodging-houses by the authorities in Helsingfors. This question is one which ought to be settled by a special sanitary regulation, according to the terms of the Code of Hygiene.

Since 1883 Helsingfors has possessed a night refuge for workmen

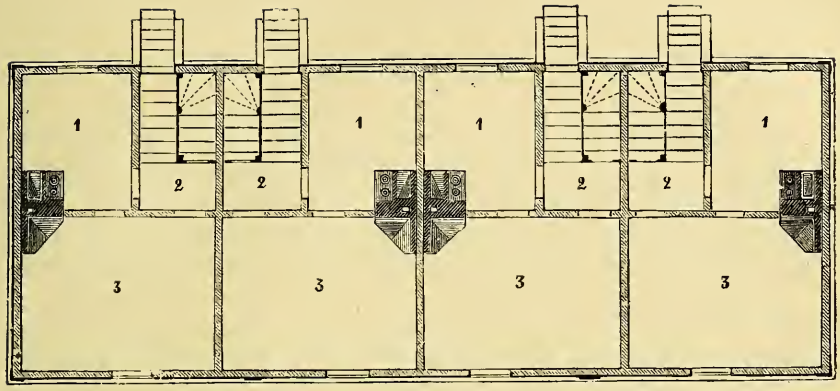


FIG. 179.—PLAN OF A HOUSE WITH FOUR TENEMENTS.
1. Kitchens. 2. Ante-rooms. 3. Dining-rooms.

established by a benevolent society. Forty-five persons can be accommodated in it.

Hygiene of Factories.—The regulations concerning the hygiene of factories are found in the Code of Hygiene of 1879 and in the new law of 1889 relating to the protection of workmen in industrial occupations.

The government has appointed a committee to draw up a plan for the establishment of an office for workmen on the model of those in Germany and Austria.

In the meantime the workmen have themselves made arrangements for mutual assistance by founding a workmen's association, a co-operative society, and an office for help in sickness and the expenses of burial.

A considerable number of manufacturers have also insured their workmen against accidents.

In the new law the sanitary oversight of factories is given to special inspectors, who are responsible to the Council of Trades (*Industristyrelsen*).

Thus one of the most important branches of public hygiene has been taken away from the medical authority and entrusted to mere officials. This arrangement does not work well.

As the Council of Trade does not include any professor of hygiene, a satisfactory result will not be attained until a competent doctor is appointed, who may be entrusted with the superintendence of the sanitary department.

Hygiene of Schools.—The Senate has issued regulations for the building and ventilation of school buildings in a circular dated the 8th of September, 1859.

Certain regulations are also found in the Code of Hygiene of 1879, but they are of too general a character to give good results.

Competition has been invited in order to ascertain the most convenient plan for building a primary school in the country. Most of the school buildings maintained by the State have been re-built within the last few

years, and now satisfy the requirements of hygiene in the arrangements and furniture of the class-rooms also. It is necessary that the staff of teachers should have some elementary knowledge of hygiene if it is to be carried out in a satisfactory manner.

The regulations with regard to the power of the sanitary authorities in relation to schools, especially in cases of epidemic, are altogether defective.

The best way of remedying this state of things would be to entrust this department of school hygiene to the authorities on public hygiene, as is done in England and Belgium. No special doctor is attached to the State schools, but private establishments lately opened and subsidised by the State have a school doctor. Several of these new schools are for pupils of both sexes who follow the same course of study in the same classes. Gymnastics are obligatory in all the Finland schools, and in some private institutions hygiene is taught to the pupils in the two upper classes.

STATISTICS.

IMPORTANCE OF PUBLIC HYGIENE.

On Mortality from General Causes and from Typhoid Fever.—England and Wales.—London.—Scotland.—Edinburgh.—Belgium.—Brussels.—France.—Paris.—Germany.—Prussia.—Berlin.—Austria.—Vienna.—Sweden.—Stockholm.—St. Petersburg.—Finland.—Helsingfors.—Births.—Mortality of Great Cities and Towns.—Mortality in the Armies.—Cholera and its Relation to Sanitary Organization.—National Loss from Defective Public Hygiene.

Universal importance of Public Hygiene: General Mortality and Mortality from Typhoid Fever.—It is only within the past twenty years that energetic measures have been taken for the prevention of disease, and the following figures will show with what results.

Typhoid fever in all great cities tends to assume an epidemic character, and of all infectious diseases it is the one which most clearly demonstrates the influence of hygienic measures. Hence the extent to which this disease prevails in a given locality may be regarded as a fairly certain index of its sanitary condition.

In the following table the rate of mortality from typhoid fever is exhibited side by side with the rate of mortality from general causes, and in order to facilitate the comparison, the former rate is estimated per 10,000, and the latter per 1,000 of the population.

ENGLAND AND WALES.

Annual Reports of Registrar-General.

Years.	Mean Population.	General Mortality per 1,000.	Mortality from Typhoid Fever per 10,000.
1850–1854	18,301,162	22·3	9·8
1855–1859	19,365,856	22·1	8·9
1860–1864	20,523,932	22·2	8·4
1865–1869	21,823,233	22·5	9·1
1870–1874	23,272,145	22·0	6·3
1875–1879	24,875,820	21·2	4·2
1880–1884	26,420,557	19·6	2·9
1885–1889	27,830,179	18·8	2·0
1890	28,762,287	19·5	1·9

From this table it appears that the general mortality descended from 22·3 to 19·0, and that from typhoid fever from 9·8 to 1·9, although the population had in the same period increased by one-third of its amount.

The diminution in the general mortality and the continuous decrease in the rate of mortality from typhoid fever, both date from the decade 1870–

80, when sanitary improvements began to be more extensively and energetically prosecuted in the cities.

London.

Annual Summary of Deaths, etc., in London.

Years.	Mean Population.	General Mortality per 1,000.	Mortality form Typhoid Fever per 10,000.
1850–1854	2,362,386	24·1	9·9
1855–1859	2,583,167	23·1	8·5
1860–1864	2,804,048	24·0	9·5
1865–1869	3,029,138	24·4	8·4
1870–1874	3,254,260	23·0	4·9
1875–1879	3,586,091	22·5	3·3
1880–1884	3,859,995	21·2	2·7
1885–1889	4,058,545	19·8	1·5
1890	4,180,021	21·4	1·5
1891	4,231,431	21·4	1·3

In 1891 the city of London[1] contained 4,231,431 inhabitants. A population so vast and concentrated within a space of 316 square kilomètres necessarily presents all the conditions favourable to the spread of infection, such as over-crowding, misery, poverty, etc.

In spite of all this, however, the above table shows that the general mortality has diminished, and also that the mortality from typhoid fever is lower in the metropolis than in England and Wales as a whole. A more decisive proof of the benefits of sanitation could scarcely be presented. The years 1890 and 1891 show a rather higher rate of mortality from all causes than the immediately preceding years, in consequence of the fatal prevalence of influenza.

Scotland.

Annual Reports of the Registrar-General in Scotland.

Years.	Mean Population.	General Mortality per 1,000.	Mortality from Typhoid Fever per 10,000.
1860–1864	3,104,810	22·2	
1865–1869	3,245,380	22·0	
1870–1874	3,355,837	22·5	
1875–1879	3,590,132	21·2	
1880–1884	3,784,827	19·7	
1885–1889	3,919,078	18·7	
1890	4,009,986	19 7	

[1] Before 1869, typhus and typhoid fevers are classed together, and the above rates include both diseases; from that date only typhoid fever is included.

EDINBURGH.

Annual Reports of the Registrar-General in Scotland.

Years.	Mean Population.	General Mortality per 1,000.	Mortality from Typhoid Fever per 10,000.
1875–1879	217,187	21·7	3·2
1880–1884	232,235	20·0	2·8
1885–1889	262,775	18·4	1·9
1890	271,135	20·0	1·9

BELGIUM.

Years.	Mean Population.	General Mortality per 1,000.	Mortality from Typhoid Fever per 10,000.
1865–1869	4,938,592	24·2	—
1870–1874	5,193,394	23·4	8·7
1875–1879	5,433,089	21·8	7·0
1880–1884	5,653,363	21·0	6·3
1885–1889	5,972,567	20·0	3·9
1890	6,147,041	20·6	—

BRUSSELS.

Years.	Mean Population.	General Mortality per 1,000.	Mortality from Typhoid Fever per 10,000.
1865–1869	163,434	31·96	10·0
1870–1874	168,966	28·50	8·6
1875–1879	164,755	27·34	4·0
1880–1884	168,290	25·22	3·3
1885–1889	178,263	22·46	2·1

It is evident from the above table that the rate of mortality from typhoid fever is less in Brussels than in Belgium taken as a whole.

FRANCE.

Years.	Mean Population.	Mortality per 1,000.
1855–1859	36,276,978	24·8
1860–1864	37,572,912	22·3
1865–1869	37,890,195	23·6
1870–1874	36,474,655 [1]	25·9
1875–1879	37,020,898	22·5
1880–1884	37,754,969	22·3
1885–1889	38,303,381	21·8
1890	38,430,000	22·8

[1] Franco-Prussian War.

PARIS.

Bulletin of Municipal Statistics. (*Bertillon.*)

Years.	Mean Population.	General Mortality per 1,000.	Mortality from Typhoid Fever per 10,000.
1850–1854	1,077,479	28·64	18·45
1855–1859	1,199,346	27·60	13·09
1860–1864	1,721,968	24·94	—
1865–1869	1,851,274	25·33	5·5
1870–1874	1,851,762	30·41 [1]	10·8
1875–1879	2,039,030	23·56	6·2
1880–1884	2,240,910	25·21	9·9
1885–1889	2,265,945	23·52	6·7
1890	2,260,945	24·5	3·0

From these tables it is evident that in France scarcely any progress has been made in public hygiene. In fact, the importance attached to the subject in France is very much less than in England.

The proposals submitted to the Chambers from time to time for the establishment of a code of public hygiene have always been rejected on the pretext that the regulations proposed would be a violation of the liberty of the subject.

In France individuals refuse to subordinate their private interests to the public good, while in England the public good is regarded as the surest safeguard of individual liberty.

By comparing the frequency of typhoid fever in London and in Paris, the relative advantages of the differing systems of drainage are clearly perceived. In London the use of water-closets is obligatory, while in Paris their introduction has until within a recent period been successfully opposed.

GERMANY.

Statistical Year-Book of the German Empire, Berlin. Monthly Issue of Statistics for the German Empire.

Years.	Mean Population.	General Mortality per 1,000.
1875–1879	43,388,800	26·4
1880–1884	45,621,000	27·3
1885–1889	47,667,000	24·6
1890	49,283,000	24·4

[1] Franco-Prussian War.

PRUSSIA.

Annual Statistics of the German Empire. Report of the Royal Statistical Bureau for the Kingdom of Prussia.

Years.	Mean Population.	Mortality per 1,000.
1885–1889	17,524,460	27·7
1860–1864	18,683,390	25·2
1865–1869	22,017,937	28·1
1870–1874	24,867,773	27·8
1875–1879	26,268,640	25·7
1880–1884	27,820,750	25·2
1885–1889	28,840,048	24·2
1890	29,818,878	24·0

BERLIN.

Publications of the Statistical Office of the City of Berlin.

Years.	Mean Population.	General Mortality per 1,000.	Mortality from Typhoid Fever per 10,000.
1850–1854	422,961	25·19	—
1855–1859	445,776	26·80	10·4
1860–1864	581,947	26·33	8·0
1865–1869	716,088	32·07	8·8
1870–1874	882,316	32·37	9·7
1875–1879	1,039,447	29·87	5·4
1880–1884	1,174,227	27·75	2·9
1885–1889	1,440,031	23·06	1·6
1890	1,548,279	21·60	0·9

The above tables show a comparatively high rate of mortality for Germany, without any constant diminution, except in the case of typhoid fever in the city of Berlin. This diminution was coincident with the new system of drainage introduced in 1872, and with the compulsory use of water-closets, which are in use at the present time.

AUSTRIA.

Austrian Statistics. Statistical Handbook for the Austro-Hungarian Monarchy. Vienna.

Years.	Mean Population.	General Mortality per 1,000.
1870–1874	20,678,922	32·5
1875–1879	21,458,288	30·6
1880–1884	22,358,194	30·1
1885–1889	23,289,991	28·9
1890	23,707,876	29·4

Vienna.

Reports of the Statistical Department for the Magistracy of Vienna.

Years.	Population.	Average.	Mortality per 1,000.	Mean Figure.	Mortality from Typhoid Fever per 10,000.	Mean Figure.
1881	731,277		28·9		2·28	
1882	740,622		29·1		2·49	
1883	749,762	...750,279	28·1	.....28·3	2 00	.....1·87
1884	759,849		26·8		1·20	
1885	769,889		28·5		1·38	
1886	780,066		26·5		0·49	
1887	790,381		25·8		1·04	
1888	800,836	...800,979	25·0	.....25·3	1·26	.....0·28
1889	811,434		24·4		1·28	
1890	822,176		24·6		0·91	

Sweden.

Years.	Mean Population.	General Mortality per 1,000.	Mortality from Typhoid Fever per 10,000.
1860–1864	3,967,118	19·4	—
1865–1869	4,160,467	20·5	—
1870–1874	4,252,509	18·2	2·7
1875–1879	4,481,662	18 7	2·3
1880–1884	4,593,014	17·6	2·3
1885–1889	4,718,509	16·5	2·2

Stockholm.

Years.	Mean Population.	General Mortality per 1,000.	Mortality from Typhoid Fever per 10,000.
1860–1864	120,296	32·97	—
1865–1869	135,570	30 55	—
1870–1874	139,255	34·23	12·8
1875–1879	152,824	27·05	5·5
1880–1884	174,201	24·89	3·0
1885–1889	231,009	20·08	2·0
1890	236,350	19·6	1·8

In Stockholm the drainage works were actively prosecuted in 1878. The service of the sewers was also improved at the same time. The figures above recorded eloquently prove the efficiency of these measures in reducing the rate of mortality in general, and that from typhoid fever in particular.

St. Petersburg.

Statistics of the Russian Empire. Annual Review of the Sanitary Statistics prepared by Dr. E. Janssens, Brussels. The Influence of Sewage and Water Supply on the Death Rate in Cities, by Irvine Smith, Lansing, Michigan, 1885.

Years.	Population.	Mean Figures.	Mortality per 1,000.	Mean Figures.	Mortality from Typhoid Fever per 10,000	Mean Figures.
1878	669,741		47·1		80·66	
1879			40·0	43·5	23·49	52·8
1880	754,704		46·1		47·69	
1881	839,677		51·4			
1882		833,219	35·2	39·4		22·52
1883	876,575		32·5		10·63	
1884	861,920		31·9		9·25	
1885	869,379		29·4			
1886	928,016		30·7			
1887		943,566	27·8	29·5	8·35	
1888	929,093		34·6		9·23	8·68
1889	978.303		28·4		8·58	
1890	956,226		28·4		5·8	

Although the sanitary organization of St. Petersburg forms no part of the present work, we have given the preceding table because it places in a clear light the sanitary condition of the Russian capital, which is in closest relations with Finland.

These statistics clearly show that St. Petersburg is an unhealthy city, but that the hygienic improvements of the last few years have done much to lessen the general mortality and to diminish the number of cases of typhoid fever.

Finland.

Years.	Mean Population.	General Mortality per 1,000.
1815–1819	1,128,010	25·0
1820–1824	1,211,136	25·4
1825–1829	1,295,463	24·6
1830–1834	1,374,612	31·0 [1]
1835–1839	1,404,504	26·0
1840–1844	1,484,767	22·0
1845–1849	1,580,055	23·7
1850–1854	1,668,301	27·7
1855–1859	1,700,439	30·2 [2]
1860–1864	1,786,264	25·9
1865–1869	1,803,173	41·0 [3]
1870–1874	1,842,553	20·7
1875–1879	1,968,336	22·4
1880–1884	2,114,187	22·6
1885–1888	2,270,194	20·4
1890	2,380,140	19·5

[1] The Cholera in 1832–34. [2] The consequence of the Crimean War.
[3] The typhus and famine of 1867–68.

Finland, which by its climate and general condition of its population, is in close resemblance with Sweden, stands comparatively low in the scale of mortality, mainly from defective sanitary organization, arising from the lack of competent officers to administer the laws. Since, however, the government is about to appoint a professor of public hygiene to the University of Helsingfors, we may hope that the country has in store for it a happier future.

HELSINGFORS.

Years.	Population.	Average.	Mortality (general) per 1,000.	Average.	Mortality from Typhoid Fever per 10,000.	Average.
1865	23,868		30·0			
1866	24,377		26·3			
1867	24,964	24,626	24·0	.....33·8		
1868	24,835		62·1			
1869	25,585		25·0			
1870	26,519		21·8			
1871	26,466		23·5			
1872	28,798	28,000	23·0	.....26·0		
1873	29,755		24·6			
1874	30,461		26·6			
1875	31,501		26·8			
1876	32,427		28·8			
1877	33,318	33,634	28·5	.....25·6		
1878	34,223		23·2			
1879	36,701		20·8			
1880	37,500		27·2			
1881	38,744		27·3			
1882	40,151	40,294	25·7	.....26·3	6·97	
1883	41,655		24·6		4·08	.....5·22
1884	43,422		26·6		4·61	
1885	45,469		21·9		7·04	
1886	47,539		25·4		4·84	
1887	49,951	52,304	19·5	.....22·2	3·00	.....4·09
1888	52,672		21·0		2·08	
1889	55,707		22·5		3·95	
1890	58,945		21·3		2·54	

Omitting the period of five years from 1867 to 1871, which was distinguished by disastrous epidemics, a slight decrease in the general mortality is noticeable, and it is only proper to admit that the improvement in the sanitary organization has contributed to this result. Nevertheless the sanitary arrangements are far from satisfactory, as the rate of general mortality and the number of cases of typhoid fever abundantly prove.

For a town of such moderate dimensions, and so favourably situated as Helsingfors, the mortality is excessive. The prevalence of typhoid fever plainly indicates that the water service, and the drainage, are in an unsatisfactory condition. The measures taken for the prevention of infectious diseases are likewise inadequate.

BIRTHS.—Since the rate of mortality is higher during the early years of

life than in subsequent years, the birth-rate has a very important influence upon the death-rate.

In the countries and towns mentioned in this work the mean birth-rate per 1,000 of the population is as follows :—

England	35·1	London	30·0
Scotland	34·7	Edinburgh	28·8
Belgium	31·5	Brussels	28·8
France	25·4	Paris	26·9
Germany	39·0	Berlin	31·0
Prussia	39·3	Vienna	33·4
Austria	37·9	Stockholm	33·3
Sweden	30·2	Helsingfors	32·7
Finland	35·5		

MORTALITY IN LARGE AND SMALL CITIES.—The greater is the density of a population in a given district, the more favourable the conditions for the production of a high rate of mortality.

The following table shows the rate of mortality from general causes, and also that from typhoid fever in seven large towns of Germany, and in twenty small ones. The comparison is favourable in this instance to the large towns, and the reason is that the sanitary arrangements in these towns are more efficient than in the smaller towns, where they are still very defective.

Publications of the Imperial Department of Public Health.
(*Irvine Smith, loc. cit.*)

Towns.	Population 1882.	Mortality per 1,000.		Mortality from Typhoid Fever per 10,000.	
		Mean for 1882.	Mean from 1878–1882.	Mean for 1882.	Mean from 1878–1882.
Frankfort am Main	140,000	20·36	20·44	1·6	1·8
Munich	238,000	38·11	39·49	1·8	5·0
Dresden	227,250	25·05	24·74	1·5	1·8
Dantzig	112,119	28·01	29·18	1·9	2·2
Breslau	280,200	31·75	31·68	2·9	3·5
Stuttgart	108,082	22·65	22·83	2·4	1·8
Hamburg	416,819	24·79	25·62	2·2	2·7
Mean		26·17	26·35	2·0	2·7

Towns.	Population 1882.	Mortality per 1,000.		Mortality from Typhoid Fever per 10,000.	
		Mean for 1882.	Mean from 1878–1882.	Mean for 1882.	Mean from 1878–1882.
Elbing	36,405	38·57	31·84	7·4	8·4
Stralsund	30,038	25·77	25·44	9·3	11·9
Stargard	21,346	28·58	26·18	6·6	8·6
Thorn	21,859	26·21	26·90	8·7	11·7
Grandenz	17,466	32·29	29·67	21·8	20·9
Posen	65,900	30·99	30·13	13·4	13·6
Bromberg	35,800	22·12	24·34	10·6	14·6
Beuthen	24,483	26·22	31·13	4·9	8·9
Schweidnitz	22,653	28·47	29·73	7·1	9·2
Halberstadt	31,300	30·54	27·92	5·4	6·1
Nordhausen	26,638	23·09	24·28	9·4	9·9
Aschersleben	19,350	24·39	25·20	7·8	6·8
Quedlinburg	18,550	27·39	26·61	8·1	5·8
Spandau	30,395	25·17	25·22	4·9	6·1
Neustadt-Magdeburg	27,696	33·43	36·32	7·6	11·3
Burg-les-Magdeburg	16,062	24·84	25·96	6·6	12·0
Luneburg	18,979	23·45	23·89	15·8	10·4
Dortmund	68,000	28·91	28·81	5·4	9·0
Essen	60,000	29·12	29·70	5·7	6·2
Colmar	26,300	27·91	29·77	4·9	5·6
Mean		27·87	27·98	8·6	9·8

MORTALITY IN THE ARMIES.—The adoption of compulsory military service has had the effect of interesting all classes of citizens in the question of military hygiene. Also during the past twenty years the sanitary service has been considerably improved in all European armies.

In the subjoined table the results obtained are presented under the usual form.

Armies.	Years.	Deaths per 1,000.	Period of Service.
Prussian	1829–38	13·1	5·7
,,	1846–63	9·7	—
English	1830–46	15·0	8·4[1]
French	1842–48	19·4	—
,,	1853–58	16·0	9·2
Russian	1841–52	37·4	—
,,	1858–68	16·5	14·2

[1] In England the conditions of service are somewhat different, since no conscription exists, and soldiers may remain under the flag until they are 40 years of age.

The general rate of mortality, and the rate from typhoid fever in these armies are given in the following table :—

Country.	General Mortality per 1,000.	Mortality from Typhoid Fever per 10,000.
Sweden	2·3	4·7
Finland	3·3	3·5
Prussia	5·7	9·5
England	8·4	3·1
France	9·2	33·7
Austria	11·2	15·9
Italy	11·6	20·9

It appears from this table that the countries of Europe stand in very different positions in regard to the general mortality, and also to the mortality from typhoid. The deaths from this last malady being occasioned by defective drainage and by bad drinking water, it follows that England stands in the first rank in regard to health, and France in the last.

Cholera in Relation to Sanitary Organization.—Typhoid fever, as the above tables clearly show, is intimately dependent upon sanitary organization. The same thing is true in the case of cholera, the published statistics of which show to what extent it is dependent upon the same circumstances.

The only difference is that cholera being a disease of tropical origin has only appeared in Europe as an occasional visitant, whilst typhoid fever has everywhere established itself as a chronic malady.

Experience has, however, shown that the places in which typhoid fever prevails are the places most liable to be attacked by cholera, and that when cholera is introduced into a town, those quarters in which typhoid fever is found are more likely to be visited by it. The localities which are badly drained, or in which the water supply is infected, or the soil is impregnated with excrementitial impurities, are the localities which are most liable to be visited by cholera.

During the epidemics which visited Europe in the years 1832 and 1887 it was notorious that the safety of a locality was in exact proportion to the efficiency of its sanitary organization. In the same town the districts less afflicted by this scourge were precisely those where a good supply of pure water was provided, and where the flushing of the drains was most carefully performed

On the first invasion of cholera in 1832, it was already observed that in London the malady showed a decided preference for those localities in which typhoid fever prevailed. This was further confirmed by the course of the cholera epidemics in 1840 and in 1849 in the same city, and subsequently by the epidemic which visited the cities of Central Europe in the year 1884.

Interesting observations on this point were made in Marseilles by the medical officer, Dr. Albenois, in 1855. The result of these observations

was to show that the mortality was much higher in those quarters of the town which had no public sewers than in the denser and dirtier districts which had been already drained. The localities which suffered most were precisely those which had been accustomed to pay an annual death-toll to typhoid fever.

In Naples also Professor Fazio has pointed out that in the course of several epidemics typhoid fever and cholera always followed the same track and attacked the same quarters of the city.

The eminent engineer, Alfred Durand-Claye, has also shown that in the city of Paris, during the cholera epidemic of 1885, the scourge visited most severely those quarters of the city which were not connected with the public system of drainage. He also showed that the districts in which the cholera cases were most numerous were just those which suffered most severely from typhoid fever.

At Buda Pesth also Dr. J. V. Fodor prepared a comparative statement of the cases from cholera and typhoid fever which occurred from 1863 to 1877. It is there shown that cholera and typhoid fever caused three and four times more deaths in the dirty and ill-managed houses than in those properly administered in the same district, and that the same thing was true of those dwellings possessing dirty courts as compared with those in which the courts were kept in good condition. These proportions are more strikingly manifest from the figures given below.

NUMBER OF DEATHS IN 100 HOUSES.

Tenements.	Cholera.	Typhoid Fever.
In good condition	92	165
Fairly good condition	199	177
Dirty condition	268	182
Very dirty condition	402	356
Courts.		
In good condition	188	159
Fairly good condition	214	186
Dirty condition	263	208
Very dirty condition	389	282

Experience has further proved that epidemic indigenous cholera, as also epidemic diarrhœa and dysentery, spread more rapidly upon sites which are favourable to typhoid fever and Asiatic cholera.

NATIONAL LOSSES RESULTING FROM DEFECTIVE ORGANIZATION OF PUBLIC HYGIENE.—That which impedes the organization of public hygiene is on the one hand ignorance of its importance and value, and on the other the initial cost of its establishment.

With regard to the question of expense, it may easily be proved that

the cost of an efficient hygiene is much less than that resulting from its absence.

That which most powerfully contributed to induce the English Parliament to adopt the code of hygiene now in force in that country was the calculation of the eminent hygienist, Dr. John Simon, by which it was shown that 125,000 died prematurely every year because of bad or insufficient sanitation. But the wealth of a nation consists almost entirely in the labour and active force of its people, and hence this number of deaths was a distinct and important national loss.[1]

The question, "At what sum the life of a man ought to be valued," has been treated in France and in England by several distinguished economists.

The result of their inquiries shows that the life of a man represents a capital sum, the interest on which is equivalent to his annual expenses.

Dr. Farr, of London, concluded from his researches that the value of the labour of each individual equally distributed among men, women, and children is about £159.

Sir Edwin Chadwick, of London, estimates the value of each individual of the working class at about £200.

Dr. Rochard, of Paris, presented to the Health Congress at La Haye in 1884 a calculation estimating the value of a human life in France at a much lower figure, viz., £40, or thereabouts.

Taking the number of preventible deaths in England to be 125,000, as above stated, and estimating the value of each life at £200, the annual loss to the English nation, previous to the introduction of an effective system of public hygiene, amounted to the colossal sum of £50,000,000 sterling.

Even this large sum is far below the truth.

Since the deaths amount to but a little more than 4 per cent. of the persons attacked, it follows that about three million of persons were confined to their beds by sickness. If we estimate 30 days for the period during which each patient was kept from work, we shall be rather under than over the mark. Also of the three million persons attacked, probably, it is estimated that one-third were of the working age, *i.e.* between 15 and 60 years old; and if 30 days be taken as the average period of absence on account of sickness, it follows that the loss to the country thereby amounted to 30 million days. The day's wages in England being equivalent to 5 francs, the total loss amounts to 150 million francs, or £6,000,000 sterling. The expenses for the maintenance of the sick, for nursing and medicine, are at least 2 francs a day, and for 3,000,000 patients during 30 days this would amount to 180 million francs, or 7½ million sterling. Thus we have—

[1] "The greater part of the national wealth is the income from the work which is the outcome from the national health."—Sir Jas. Paget ("National Health and Work," London, 1884).

Loss occasioned by death	=	500,000,000 francs.
Value of days lost through illness	=	150,000,000 „
Expenses of sickness	=	180,000,000 „
Total		830,000,000 „

Thus the loss to England each year arising from defective sanitary organization amounted to over £33 million sterling.

From the calculations of Dr. Rochard, it appears that the annual loss occasioned to France by deaths and sickness amounts to £70,000,000 sterling, and if this amount could be reduced by only one-tenth, the gain to France would be at least seven million sterling per annum.

If in Finland the mortality were reduced to the same proportion as that of Norway and Sweden, that is to say to 17 per 1,000, a supposition which is not extravagant considering the close natural affinities existing between these countries and the similarity in the condition of the inhabitants, there would result a diminution of the annual deaths in Finland amounting to at least 11,017 persons.

Adopting therefore the same method of calculation as above employed, and assigning to each life in Finland a value of £25, counting only 1 franc a day for wages, and only 25 centimes for the expenses of a patient per day, the annual gain to Finland would amount to more than £630,000 sterling.

What important improvements could be effected in public hygiene with only a small fraction of this amount we need not stop to point out!

COMPARISON OF METRIC AND ENGLISH WEIGHTS AND MEASURES.

FOR the convenience of those unfamiliar with the Metric System, the following comparative data are given :—

1 inch = 2·539954 centimètre.	1 centimètre = 0·03937 inch.
1 foot = 3·0479449 decimètre.	1 decimètre = 3·93708 inch.
1 yard = 0·9143835 mètre.	1 mètre = 39·37079 inches.
1 mile = 1·6093149 kilomètre.	1 kilomètre = 0·62138 mile.
1 sq. inch = 6·4513669 sq. centimètres.	
1 sq. foot = 9·2899683 sq. decimètres.	
1 sq. yard = 0·83609715 sq. mètre or centiare.	1 centiare = 10·764299 sq. feet.
1 acre = 0·40467102 hectare.	1 hectare = 2·47114 acres.
1 sq. mile = 2·58989451 sq. kilomètres.	
1 cubic inch = 16·386176 cubic centimètres.	1 cubic centimètre = 0·00176 pint.
1 cubic foot = 28·315312 cubic decimètres.	1 cubic decimètre or litre = 1·76077 pint.
1 gallon = 4·543458 litres.	
1 grain = 0·064799 gramme.	1 gramme = 15·43235 grains.
1 Troy oz. = 31·103496 grammes.	1 kilogramme = 2·20462 lbs. Avoirdupois.
1 lb. Avoirdupois = 0·453593 kilogrammes.	
1 cwt. = 50·802377 kilogrammes.	

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